

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

SIEMENS MEDICAL SOLUTIONS USA,
INC.,

Plaintiff,

V.

SAINT-GOBAIN CERAMICS &
PLASTICS, INC.,

Defendant.

C.A. No. 07-190 (SLR)

REDACTED
PUBLIC VERSION

DECLARATION OF CHARANJIT BRAHMA

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Original Filing Date: November 5, 2007
Redacted Filing Date: November 12, 2007

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

SIEMENS MEDICAL SOLUTIONS USA, INC.,

Plaintiff,

v.

SAINT-GOBAIN CERAMICS & PLASTICS, INC.,

Defendant.

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: Civil Action No. 07-190 SLR
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DECLARATION OF CHARANJIT BRAHMA

I, Charanjit Brahma, hereby declare:

1. I am a partner at the law firm of Kirkland & Ellis LLP ("Kirkland"), which represents Siemens Medical in the above-captioned matter.

2. The Court's scheduling order with respect to discovery and briefing concerning Siemens Medical's motion for preliminary injunction was entered August 8, 2007 based on the parties stipulated proposal. According to that schedule, the parties agreed to complete written discovery by August 17, 2007.

3. As that deadline approached, Saint-Gobain's counsel indicated that it would not be able to produce all of its documents and discovery responses by the deadline and sought additional time to produce *some* of their documents and written interrogatory and RFA responses. Siemens Medical agreed to Saint-Gobain's "rolling" proposal on the condition that all such documents and discovery responses would be provided by August 31, 2007. Saint-Gobain agreed to both conditions, and Siemens Medical produced documents on August 17 and

then concluded its production on August 31.¹ (Ex. 1, September 7, 2007 letter from G. LoCascio to F. Whitmer confirming agreement.)

4. Saint-Gobain, on the other hand, only began to produce documents (as well as its responses to Siemens Medical's interrogatories and requests for admission) on August 31. (Ex. 2, August 31, 2007 e-mail from J. Ohman to C. Brahma.) Saint-Gobain did not produce documents or discovery responses on a "rolling" basis starting on August 17. Saint-Gobain's initial document production consisted of a total of 1131 pages.

5. Saint-Gobain produced another 10,308 pages between September 17 and October 9. (Ex. 3, September 17, 2007, September 20, 2007, September 25, 2007, September 26, 2007, September 27, 2007, October 2, 2007 and October 9, 2007 letters from J. Ohman to C. Brahma) Saint-Gobain's belated production of those documents hampered Siemens Medical's ability to prepare for Saint-Gobain's opposition brief, which was originally due on October 10 but for which the deadline was extended to October 17 at Saint-Gobain's request (Ex. 4, October 4, 2007 e-mail from F. Whitmer to C. Brahma).

6. Since Saint-Gobain submitted its opposition brief on October 17, it has produced nearly four times as many documents as before that date.

7. Due to the extensions sought by Saint-Gobain, Siemens Medical had one week from the date it received Saint-Gobain's opposition brief and supporting declarations to prepare to depose Saint-Gobain's fact witness, Michael Mayhugh. Siemens Medical prepared for that deposition based on Mr. Mayhugh's affidavit, Saint-Gobain's brief, and the materials that had Saint-Gobain produced prior to the Mayhugh deposition—a total of 11,439 pages.

8. In that period, the parties were in regular e-mail and other contact about deposition scheduling (and had seen each other in person at the two depositions of Siemens'

¹ On September 7th, Siemens Medical provided Saint-Gobain with an additional 112 pages that were inadvertently omitted from the August 31st production due to a photocopying error.

witnesses). At no point prior to the Mayhugh deposition did anyone representing Saint-Gobain notify Siemens Medical's counsel that Saint-Gobain had not produced all of its responsive documents. Many of the withheld documents directly involved Mr. Mayhugh himself.

9. On October 23, 2007, counsel for Siemens traveled to New York to take the Mayhugh deposition the next day, October 24, at Saint-Gobain's counsel's New York office. Mr. Ohman defended Mr. Mayhugh's deposition. (Ex. 5, Mayhugh Dep. at 5:4-6.) While that deposition was taking place in New York, approximately 4,500 more pages produced by Saint-Gobain were delivered to Siemens Medical's counsel's *Washington, D.C. office*. (Ex. 6, October 23, 2007 letters from J. Ohman to C. Brahma).

10. Although Mr. Ohman originally suggested that perhaps those materials were the remnants of their production of foreign documents and did not involve Mr. Mayhugh's files, the handful that Siemens Medical's counsel was able to have skimmed and faxed by colleagues in Washington to use in the deposition revealed otherwise and were admitted by Mayhugh to be memos and emails prepared by him.

11. Over Siemens Medical's counsel's stated objection, Saint-Gobain ended Mr. Mayhugh's deposition before the 7-hour limit had elapsed due to the witnesses' travel plans. (Ex. 5, Mayhugh Dep. at 306:25-308-18.) At the conclusion of the deposition, Siemens counsel expressed its displeasure at having documents obviously relevant to the Mayhugh deposition produced not only simultaneously with the Mayhugh deposition, but in another city. (*Id.*) At no point during the deposition did Saint-Gobain's counsel reveal that additional documents were being produced.

12. According to Federal Express shipping records (Ex. 7), at 4:42 PM that same day, less than an hour before the conclusion of the Mayhugh deposition, Saint-Gobain's counsel shipped another approximately 12,500 pages of documents from their New York office to

Siemens Medical's counsel, which arrived in Washington the day after the Mayhugh deposition. (Ex. 8, October 24, 2007 letters from J. Ohman to C. Brahma.)

13. The documents produced by Saint-Gobain on the day of and the day after Mr. Mayhugh's deposition more than doubled the number of documents produced by Saint-Gobain to that point (from 11,439 to 28,357 documents).

14. As Siemens Medical prepared to depose Saint-Gobain's expert witness on November 2, 2007 Saint-Gobain produced yet another set of more than 13,000 documents on October 31, 2007 without providing Siemens Medical's counsel any justification or explanation. (Ex. 9, October 30, 2007 letters from J. Ohman to C. Brahma.)

15. At that point, Siemens Medical's counsel was unable to review the materials Saint-Gobain produced and re-depose Saint-Gobain's witness in advance of the hearing, much less today's briefing deadline. For this reason, Siemens Medical's counsel contacted Saint-Gobain's counsel to (1) ask that Saint-Gobain voluntarily withdraw the Mayhugh declaration to temporarily resolve this issue; and (2) determine if there were any more documents still to come. On the phone on October 31, counsel indicated that few, if any, documents were still to be produced.

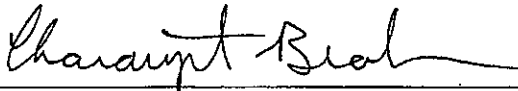
16. On November 1, Saint-Gobain indicated by letter that it refused to withdraw the Mayhugh affidavit. (Ex. 10, November 1, 2007 letter from J. Ohman to G. LoCascio.) That letter did not identify that any further documents would be received. (*Id.*)

17. Last Friday (November 2, 2007), while Siemens Medical's counsel was deposing Saint-Gobain's expert witness in Santa Fe, New Mexico, Saint Gobain's counsel left a message at Siemens Medical's counsel's Washington, D.C. office indicating that it was producing *eleven more boxes* of documents, and that those documents would be shipped for Monday delivery so that they would arrive today, the day Siemens' reply brief is due.

18. Exhibit 11 is a true copy of portions of Interference Proceeding 105083.
19. Exhibit 12 is a true copy of Plaintiff's Exhibit 10, introduced at the deposition of Michael Mayhugh, and bearing Bates Numbers SGCP001764-73.
20. Exhibit 13 is a true copy of the document bearing Bates Numbers SGCP 028468-69.
21. Exhibit 14 is a true copy of the document bearing Bates Number SGCP018526.
22. Exhibit 15 is a true copy of portions of the Deposition of Kenneth McClellan, PhD, taken November 2, 2007.
23. Exhibit 16 is a true copy of the document bearing Bates Numbers SGCP002151.
24. Exhibit 17 is a true copy of A & L Technologiy v. ReSound Corporation, No. C 93-00107 CW, 1995 U.S. Dist. LEXIS 22443 (N.D. Cal. Mar. 10, 1995).
25. Exhibit 18 is a true copy of the document bearing Bates Number SGCP012574.
26. Exhibit 19 is a true copy of the document bearing Bates Numbers SGCP012090.
27. Exhibit 20 is a true copy of the document bearing Bates Number SGCP018526.
28. Exhibit 21 is a true copy of the Interdict on litigation in Scotland between Siemens Medical and Photonic Materials, Inc.
29. Exhibit 22 is a true copy of portions of the Deposition of Marvin J. Weber, PhD, taken October 10, 2007.
30. Exhibit 23 is a true copy of United States Patent No. 6,323,489.

I hereby declare, under penalty of perjury, that the foregoing statements are true and correct to the best of my personal knowledge.

Date: November 5, 2007



Charanjit Brahma

CERTIFICATE OF SERVICE

I, the undersigned, hereby certify that on November 12, 2007, I electronically filed the foregoing with the Clerk of the Court using CM/ECF, which will send notification of such filing(s) to the following:

Kelly E. Farnan, Esquire
RICHARDS, LAYTON & FINGER, P.A.

I also certify that copies were caused to be served on November 12, 2007 upon the following in the manner indicated:

BY ELECTRONIC MAIL and HAND DELIVERY

Kelly E. Farnan, Esquire
RICHARDS, LAYTON & FINGER, P.A.
One Rodney Square
Wilmington, DE 19801

BY ELECTRONIC MAIL

Frederick L. Whitmer, Esquire
THELEN REID BROWN RAYSMAN & STEINER LLP
875 Third Avenue
New York, NY 10022

/s/ Maryellen Noreika

Maryellen Noreika (#3208)

EXHIBIT 1

KIRKLAND & ELLIS LLP

AND AFFILIATED PARTNERSHIPS

655 Fifteenth Street, N.W.
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Gregg F. LoCascio
To Call Writer Directly:
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September 7, 2007

VIA EMAIL AND FEDERAL EXPRESS

Kelly E. Farnan
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Frederick L. Whitmer, Esq.
Thelen Reid Brown Raysman & Steiner LLP
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Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics & Plastics, Inc.
(D. Del. Civil Action No. 07-190 SLR)

Dear Fred & Kelly:

I write regarding several apparent deficiencies in Saint-Gobain's responses to Siemens Medical's discovery requests. Given that we previously agreed to Saint-Gobain's request for an extension to respond to discovery and the limited period for discovery related to Siemens Medical's motion for preliminary injunction, please provide the information identified below by no later than September 13, 2007.

As an initial matter, I note that Siemens Medical agreed to extend Saint-Gobain's request for an additional two-weeks to respond to Siemens Medical's discovery requests based on your representations that (1) Saint-Gobain would be producing materials and providing discovery responses on a rolling basis over those two weeks, and (2) that Saint-Gobain would be making a good faith effort to produce the requested documents and information. As a result, we agreed to your requested extension and were then surprised when we did not receive a single Saint-Gobain production document nor a single interrogatory or RFA answer during the two weeks and instead received nothing until the conclusion of the two-week extension on August 31st. Even then, we were further surprised to see that, after the extended deadline had passed, Saint-Gobain still produced only a total of 163 pages in response to Siemens Medical's 24 document requests and has refused to identify through an outstanding interrogatory whose files were searched to find documents responsive to the document requests.

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As for the “substance” of Saint-Gobain’s interrogatory responses, as set forth below Saint-Gobain’s responses wholly fail to address several critical categories of information and must be remedied promptly given the situation and schedule.

Interrogatory No. 1: It is not “premature” for Saint-Gobain to have to identify patent claim terms that it contends must be construed and to provide constructions for those terms. Saint-Gobain’s flat refusal to do so is improper and stymies the discovery and preliminary injunction process and schedule we agreed to and the Court entered. To the extent Saint-Gobain will contend the ‘080 patent is invalid or that it did not infringe the ‘080 patent, both inquiries involve as their first step the proper construction of any disputed claim terms. While Siemens Medical believes that all of the claim terms can be construed according to their ordinary meanings and, therefore, do not need Court construction, we produced the documents needed for claim construction (e.g., the patent prosecution histories) so that Saint-Gobain could quickly identify any claim terms whose meaning it disputed. Please either respond to this interrogatory immediately or confirm that Saint-Gobain agrees there are no claim terms that require construction by the Court.

Interrogatory No. 2: The interrogatory requires Saint-Gobain to “describe in detail the factual and legal basis for Saint-Gobain’s contention that it ‘ha[s] not infringed, and do[es] not infringe, ... any claim of the ‘080 Patent, either literally or under the doctrine of equivalents.” Saint-Gobain’s bare-bones response – that it “believes that there are substantial differences between the LYSO crystals that it manufactures, sells or offers for sale and the LSO crystals that are disclosed in connection with the claims contained in the ‘080 patent” – is about as far from a “detailed” response as possible and is insufficient. While Saint-Gobain’s response makes clear that Saint-Gobain contends that the “insubstantial differences” test – and only that test – should be applied, Saint-Gobain has not described what properties show the “substantial differences” Saint-Gobain claims exist between LYSO and LSO crystals. Indeed, Saint-Gobain’s response is nothing more than a regurgitation of the “insubstantial differences” test itself. Please confirm that Saint-Gobain will not argue that its LYSO crystals do not satisfy the “scintillator” element of the claims of the ‘080 patent under the doctrine of equivalents when any other test for equivalence is applied. Please also specifically identify the differences between Saint-Gobain’s LYSO crystals and the claimed LSO crystals that Saint-Gobain contends are substantial. Given that this issue is the crux of the pending preliminary injunction motion, the promptness of Saint-Gobain’s response is critical and required to avoid an ambush by Saint-Gobain in discovery.

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Interrogatory No. 3: The interrogatory requires Saint-Gobain to “describe in detail the development and design for each Accused Product, identify all individuals and entities involved therein and describe their respective roles.” Rather than responding to the interrogatory, Saint-Gobain incorrectly invokes “Rule 33(c).” We presume you actually intended to refer to Rule 33(d), but even that provision does not apply here. Rule 33(d) may only be invoked where “the burden of deriving or ascertaining the answer [to the interrogatory] is substantially the same for [Siemens Medical] as for [Saint-Gobain].” That is clearly not the case here, since Saint-Gobain alone has access to all of the individuals involved in the development and design processes for its products. Moreover, even if Rule 33(d) applied, Saint-Gobain has not provided the information necessary to invoke that provision, namely, a specification of the records by specific Bates-number or other means from which the answer to the interrogatory may be derived “in sufficient detail to permit [Siemens Medical] to locate and to identify, as readily as can [Saint-Gobain], the records from which the answer may be ascertained.” See *Willemijn Houdstermaatschaap BV v. Apollo Computer Inc.*, 707 F. Supp. 1429, 1440 (D. Del. 1989) (rejecting a similar interrogatory response that merely stated that responsive documents had been produced). Moreover, even going beyond our obligation to try to move this along given the paucity of Saint-Gobain’s 163 page document production, the answer to Siemens Medical’s interrogatory is nowhere to be found in those documents. Please provide a complete response to this interrogatory immediately.

Interrogatory No. 4: The interrogatory requires Saint-Gobain to describe in detail the factual and legal basis for its contention, if any, that Siemens Medical is barred from asserting the doctrine of equivalents. Saint-Gobain’s response that this interrogatory is premature at this stage is either premised on the stipulation that Saint-Gobain will not argue that Siemens Medical is barred from asserting the doctrine of equivalents in its opposition to Siemens Medical’s motion for preliminary injunction or is otherwise improper. Accordingly, please confirm that Saint-Gobain does not intend to argue that Siemens Medical is barred from asserting the doctrine of equivalents or provide a complete response to the interrogatory immediately.

Interrogatory No. 5: The interrogatory requires Saint-Gobain to not only identify the prior art it claims renders the ‘080 patent invalid, but also describe how that prior art invalidates the patents. While Saint-Gobain has identified some prior art, its response does nothing to describe how that art shows on an element-by-element basis that the ‘080 patent claims are either anticipated or obvious. Please supplement Saint-Gobain’s response to provide this information.

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Interrogatory No. 6: The interrogatory requires Saint-Gobain to describe the factual and legal basis for its contention that the '080 patent is unenforceable, if Saint-Gobain so contends. Saint-Gobain's objection that the interrogatory is premature at this stage is again either premised on the stipulation that Saint-Gobain will not argue that the patent is unenforceable in opposing Siemens Medical's motion for preliminary injunction or is improper. Please confirm that Saint-Gobain does not intend to make this argument in opposition to the pending motion or provide a satisfactory response immediately.

Interrogatory No. 7 and Document Request No. 11: Saint-Gobain's response to this interrogatory "refers to its response to [Siemens Medical's Document] Request No. 11 ... where Saint-Gobain identifies all customers and potential customers to whom Saint-Gobain has sold or offered to sell activated, lutetium-based orthosilicate single crystal products, together with information concerning the volume and dollar value of any such sales made, to date, which may include responsive information." However, the document request response contains no such information – it merely states that a such a summary document will be produced, which after another week still does not appear to have been provided by Saint-Gobain. In addition, Saint-Gobain must do more than merely "refer" to a document and should state the information it is aware of in the interrogatory response itself, which it must verify under oath. Please produce the document and respond to this interrogatory without further delay.

Interrogatory No. 8: Saint-Gobain's response to this interrogatory does not identify where the Accused Products are used or imported and it does not identify any other entities involved in making, selling, using or importing the Accused Products. Please supplement Saint-Gobain's response to provide this information.

Interrogatory No. 9 and Document Request Nos. 12 and 13: The interrogatory requires Saint-Gobain to identify "all substantial uses known to Saint-Gobain" for each Accused Product, including uses that Saint-Gobain considers to be non-infringing. Saint-Gobain's refusal to respond to this interrogatory is improper. Indeed, I was of the understanding from conversations you have had with me and Gregg LoCascio that Saint-Gobain was not aware of any such uses and would not be contesting this issue, certainly not at this stage. Again, unless Saint-Gobain is willing to stipulate that the Accused Products have no non-infringing uses, please respond to the interrogatory in full.

Moreover, Siemens Medical's Document Request Nos. 12 and 13 require Saint-Gobain to produce all documents concerning any substantial uses of its Accused Products. Saint-Gobain has improperly refused to produce documents responsive to this document request

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“unless and until Saint-Gobain first determines whether, for purposes of Siemens Medical’s pending preliminary injunction motion, Saint-Gobain intends to address contentions that the Accused Product is or is not a staple item of commerce,” while at the same time refusing to admit that the Accused Products have no substantial non-infringing use in response to Siemens Medical’s Request for Admission Nos. 60-62. Saint-Gobain cannot have it both ways. Please immediately produce all documents related to any substantial use of the Accused Products or admit that Saint-Gobain’s LYSO crystals have no substantial non-infringing use and are not staple articles of commerce.

Interrogatory No. 10: The interrogatory requires Saint-Gobain to disclose the basis for its prosecution history estoppel defense. The interrogatory is not “premature” as Saint-Gobain contends, because Saint-Gobain already asserted the defense in its Answer and either had a basis for that defense or should never have included it in the first place. Moreover, all of the evidence that would seem to be necessary for Saint-Gobain’s defense, namely, the ‘080 patent and its prosecution history file, were disclosed to Saint-Gobain well over a month ago. Accordingly, there is no reason for Saint-Gobain to withhold this information – please respond to the interrogatory at once.

Interrogatory No. 11: The interrogatory requires Saint-Gobain to describe the field of art relevant to the claims of the ‘080 patent and the level of ordinary skill in that field of art. This information is plainly relevant to the invalidity defense that Saint-Gobain has indicated it intends to assert in opposing Siemens Medical’s motion for preliminary injunction and which was also raised in Saint-Gobain’s Answer. Accordingly, it is not premature, and Saint-Gobain must respond to the interrogatory immediately.

Interrogatory No. 12: The interrogatory requires Saint-Gobain to disclose the bases for its laches, waiver, and estoppel defenses. These defenses require that Siemens Medical have notice of Saint-Gobain’s infringing activities and, from the point that notice is received, unreasonably delay enforcing the patent to prevent Saint-Gobain’s continuing infringement. But, Saint-Gobain’s response to the interrogatory does not even allege when Siemens Medical supposedly was notified of Saint-Gobain’s infringing acts. Based on the lack of any good faith basis for these defenses, please confirm that Saint-Gobain will withdraw these defenses at once or provide a more thorough response immediately so this can be discussed further.

Interrogatory No. 14: The interrogatory requires Saint-Gobain to identify the individuals and groups from which it sought documents in response to Siemens Medical’s document requests. Because of the straightforward and entirely proper nature of such a request,

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Saint-Gobain can only muster an objection that merely identifying that list of names that counsel undoubtedly already has is somehow “unduly burdensome.” Indeed, Saint-Gobain’s refusal to identify the sources of its documents casts serious doubt on whether Saint-Gobain has made a good faith effort to respond to Siemens Medical’s discovery requests (even after the extension was granted), particularly when paired with Saint-Gobain’s paltry 163-page document production to date. Please respond fully to this interrogatory immediately so that Siemens Medical can evaluate the thoroughness of Saint-Gobain’s efforts to comply with its discovery obligations and adequately prepare to cross-examine Saint-Gobain witnesses and affiants.

Request for Admission No. 16: Saint-Gobain states that “the information presented [in its product literature] is representative of energy resolution achieved with some LYSO crystals currently offered and sold, but in practice energy resolution varies substantially with crystal geometry and treatment and other measurement details and may vary widely from the values reported.” In light of that, please confirm that Saint-Gobain will not argue that the difference in energy resolution between its LYSO crystals and the crystals in the asserted patent claims is “substantial” or creates a “result” that is not substantially the same as for the crystals in the asserted patent claims.

Requests for Admission Nos. 17-25 and Document Request No. 14: These requests for admission require Saint-Gobain to state whether its LYSO crystals have substantially the same properties as reported in the Affidavit of Niraj Doshi. Saint-Gobain’s refusal to answer these requests “unless and until a factual dispute arises in this action over the composition of the commercially-available activated, lutetium-based orthosilicate single crystal product that Saint-Gobain has made available to any customer” makes no sense. Please admit that the properties of Saint-Gobain’s LYSO crystals are as reported by Siemens Medical based on its testing or, if Saint-Gobain intends to contest the properties of its crystals, indicate which properties you contend have been inaccurately determined by Siemens Medical’s testing and immediately provide a complete answer to Document Request No. 14. The properties of Saint-Gobain’s crystals are at the heart of the infringement analysis and if the parties do not truly dispute those properties, Saint-Gobain has an obligation to admit RFAs on that issue.

Requests for Admission Nos. 26-29: These requests for admission require Saint-Gobain to state whether the sample LYSO crystals procured from Saint-Gobain that Siemens Medical tested are representative of the Accused Products sold by Saint-Gobain in the United States and/or to Philips. Saint-Gobain has refused to respond to the requests on the grounds that Saint-Gobain “lacks knowledge or information sufficient to form a belief as to the accuracy of the facts sought to be admitted” or that it “seeks information outside the scope of [Saint-

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Gobain's] knowledge." Please let us know whether Saint-Gobain believes it will acquire information to allow it to admit or deny these requests at some future time and, if so, specify what information Saint-Gobain is waiting to acquire, when Siemens Medical can expect that Saint-Gobain will have acquired it, and explain the efforts Saint-Gobain has made to obtain the necessary information. As you know, the use of an "insufficient information to admit or deny" response is limited and cannot be used to avoid RFAs even where the information is in the possession of a third party if Saint-Gobain or its counsel could determine that information through reasonable inquiry. *See, e.g., Henry v. Champlain Enter.*, 212 F.R.D. 73, 78 (N.D.N.Y. 2003) (Rule 36 requires the responding party "to make a reasonable inquiry, a reasonable effort, to secure information that is readily available from persons and documents within the responding party's relative control and to state fully those efforts," including, in certain circumstances, seeking information from non-parties).

Request for Admission No. 30: It is difficult to imagine how this request for admission, which relates to whether Saint-Gobain had notice of the '080 patent by a date certain, could be "premature." Saint-Gobain has not identified any discovery that it needs in order to be able to respond – indeed, the facts needed to respond are uniquely within Saint-Gobain's control. To the extent Saint-Gobain intends to oppose Siemens Medical's motion for preliminary injunction by arguing that it did not have the requisite knowledge of the '080 patent to be a contributory infringer or to induce infringement, the request is clearly relevant and must be answered as part of the discovery to be completed at this stage. Please respond to this request for admission immediately.

Requests for Admission Nos. 32-40 and 60-62: Saint-Gobain refuses to respond to these requests for admission on the ground that they "seek[] an opinion on a legal theory, not a fact, subject to an 'admission.'" Saint-Gobain's objection is without merit, as Rule 36(a) explicitly permits Siemens Medical to serve requests for admission directed to "statements or opinions ... of the application of law to fact." Please withdraw Saint-Gobain's objections and respond to these requests for admission immediately.

Document Request Nos. 4 and 8: Saint-Gobain improperly limits its responses to these requests to products "sold or offered for sale by Saint-Gobain." Siemens is entitled to documents and information in the possession or control of the named Saint-Gobain entity regarding any activated, lutetium-based orthosilicate single crystal, whether or not the crystal is sold or offered for sale by the named Saint-Gobain entity itself.

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Document Request Nos. 16 and 17: Saint-Gobain improperly limits its responses to these requests to documents “concerning any license ... to which Saint-Gobain is a party.” Siemens is entitled to the requested documents concerning licenses in the possession, custody, or control of Saint-Gobain no matter whether Saint-Gobain is a party to the license. Please confirm that Saint-Gobain will produce all requested licensing documents responsive to these requests.

With respect to other document requests, Saint-Gobain responded that it will produce all non-privileged documents that are relevant and responsive. I find it either hard to believe or quite troubling that Saint-Gobain has only 163 pages of documents that are relevant and responsive. Please confirm that Saint-Gobain will produce the remaining documents in its possession, custody, and control and confirm that it will supplement its written discovery responses on the issues raised above by September 13, 2007 so that we need not trouble the Court with these issues.

Sincerely,



Gregg P. LoCascio

cc: Jack Blumenfeld, Esq.

EXHIBIT 2

"Ohman, John C."
<JOhman@thelen.com
>

08/31/2007 01:03 PM

To "Charanjit Brahma" <cbrahma@kirkland.com>
cc "Whitmer, Frederick" <FWhitmer@thelen.com>,
"Gregg LoCascio" <glocascio@kirkland.com>, "Sean
McEldowney" <smceldowney@kirkland.com>,
<scunning@kirkland.com>
bcc

Subject RE: Siemens Medical v Saint-Gobain: Revised draft
of proposed protective order

Charan,

We will shortly be delivering to your attention defendant's initial document production, subject to the agreement memorialized in your August 17th letter and confirmed below (by which we, of course, will also abide). Today we will also be serving defendant's responses and objections to plaintiff's first sets of interrogatories and requests for admissions, respectively, the latter being served subject to the same agreement. As Fred Whitmer has advised you, defendant will produce additional documents as they become available.

Thank you for the revised protective order, to which I will respond after I have had a chance to discuss with my client. I anticipate getting back to you promptly with any comments so that we can finalize the document and get it entered.

Very truly yours,

John

-----Original Message-----

From: Charanjit Brahma [mailto:cbrahma@kirkland.com]
Sent: Friday, August 31, 2007 10:58 AM
To: Ohman, John C.
Cc: Whitmer, Frederick; Gregg LoCascio; Sean McEldowney;
scunning@kirkland.com
Subject: Siemens Medical v Saint-Gobain: Revised draft of proposed
protective order

John -

In response to your voicemail from yesterday evening, this will confirm our earlier agreement (which was spelled out more fully in my cover letter of August 17, 2007 with Siemens Medical's initial production of documents) that all documents marked as confidential, restricted confidential or the like will be treated as "outside counsel's eyes only" until a protective order is entered by the Court and that, in the event no such order is entered, the documents will be returned. Based on your voicemail, it is my understanding that, given our agreement regarding the treatment of such information, you will be sending us today documents from Saint-Gobain in response to Siemens Medical's first set of document requests, as well as Saint-Gobain's responses to Siemens Medical's first sets of interrogatories and requests for admission. Please let me know if that is not the case and if there are any other documents that Saint-Gobain anticipates producing after today's

deadline.

I am also attaching below the revised draft of the protective order based on your previous comments. Please let me know if Saint-Gobain agrees to this revised version or if you would like to discuss and additional revisions.

(See attached file: Proposed Protective Order (draft 8-31-07 to S-G).DOC)

Thanks,
Charan

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, D.C. 20005
Tel: (202) 879-5148
Fax: (202) 654-9423

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EXHIBIT 3

THELEN REID BROWN
RAYSMAN & STEINER ^{LLP}
ATTORNEYS AT LAW

John C. Ohman
Partner
212.603.6784 Direct Dial
johman@thelen.com

NEW YORK • SAN FRANCISCO • WASHINGTON, DC • LOS ANGELES
SILICON VALLEY • HARTFORD • NORTHERN NEW JERSEY • SHANGHAI

September 17, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

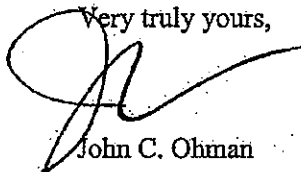
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP 001132-001446) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The enclosed documents are being provided to you subject to the agreement memorialized in your August 17, 2007 letter that all documents marked as "confidential," "restricted confidential" or the like will be treated by the receiving party as "outside counsel's eyes only" until a protective order has been entered by the Court and that, in the event no such order is entered, the documents will be returned.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

JCO:esg
Enclosures

NY #1188175 v1

THELEN REID BROWN
RAYSMAN & STEINER LLP
ATTORNEYS AT LAW

John C. Ohman
Partner
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johman@thelen.com

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September 20, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

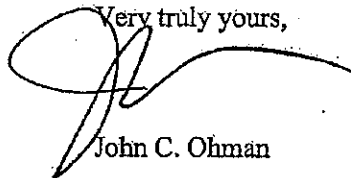
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP 001447-002720) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The enclosed documents are being provided to you subject to the agreement memorialized in your August 17, 2007 letter that all documents marked as "confidential," "restricted confidential" "attorney's eyes only" or the like will be treated by the receiving party as "outside counsel's eyes only" until a protective order has been entered by the Court and that, in the event no such order is entered, the documents will be returned.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

JCO:esg
Enclosures

NY #1189242 v1

THELEN REID BROWN
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John C. Ohman
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johman@thelen.com

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September 25, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

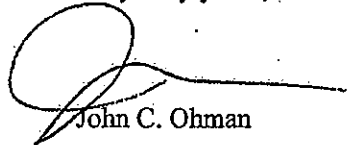
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP002721 – SGCP002913) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The enclosed documents are being provided to you subject to the agreement memorialized in your August 17, 2007 letter that all documents marked as "confidential," "attorney's eyes only" or the like will be treated by the receiving party as "outside counsel's eyes only" until a protective order has been entered by the Court and that, in the event no such order is entered, the documents will be returned.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

JCO:esg
Enclosures

NY #1189242 v2

THELEN REID BROWN
RAYSMAN & STEINER LLP

John C. Ohman
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212.603.6784 Direct Dial
johman@thelen.com

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September 26, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

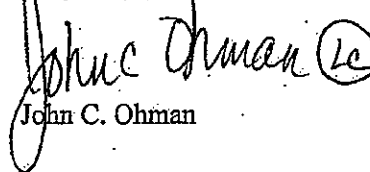
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP002914 – SGCP003871) that are responsive to Plaintiff's First Set of Requests for Production of Documents. As per Defendant's Supplemental Responses and Objections to Plaintiff's First Set of Interrogatories No. 7, the sales spreadsheets are produced herein with bates numbers SCGP003670 – SCGP003681. The enclosed documents are being provided to you subject to the agreement memorialized in your August 17, 2007 letter that all documents marked as "confidential," "attorney's eyes only" or the like will be treated by the receiving party as "outside counsel's eyes only" until a protective order has been entered by the Court and that, in the event no such order is entered, the documents will be returned.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

THELEN REID BROWN
RAYSMAN & STEINER LLP
ATTORNEYS AT LAW

John C. Ohman
Partner
212.603.6784 Direct Dial
johman@thelen.com

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September 27, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP004115 – SGCP007892) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007. However, to the extent defendants have produced documents marked "ATTORNEY'S EYES ONLY", or "CONFIDENTIAL – ATTORNEY'S EYES ONLY" those documents are to be treated by the receiving party as "RESTRICTED CONFIDENTIAL—FOR OUTSIDE COUNSEL'S EYES ONLY." Please let us know if that presents any problem.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

THELEN REID BROWN
RAYSMAN & STEINER^{LLP}
ATTORNEYS AT LAW

John C. Ohman
Partner
212.603.6784 Direct Dial
johman@thelen.com

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October 2, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

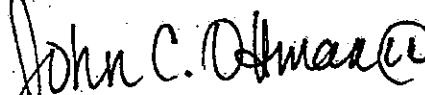
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP008670 – SGCP009246) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

received
10/5/07

THELEN REID BROWN
RAYSMAN & STEINER LLP

John C. Ohman
Partner
212.603.6784 Direct Dial
johman@thelen.com

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October 9, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

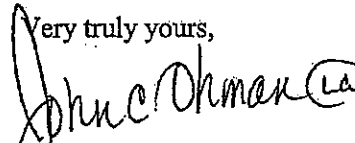
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP009247 – SGCP011439) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

EXHIBIT 4

"Whitmer, Frederick"
<FWhitmer@thelen.com>
m>

10/04/2007 02:37 PM

To "Charanjit Brahma" <cbrahma@kirkland.com>

cc <faman@rff.com>, "Ohman, John C."
<JOhman@thelen.com>

bcc

Subject RE: Scheduling

Charan, I have asked Kelly to do the 7 day extension. Our brief is now due October 17 by this schedule and your reply on Guy Fawkes Day, November 5. To the extent there was any confusion, I trust that this will alleviate it.

PLEASE NOTE NEW PHONE AND FAX NUMBERS SHOWN BELOW

Frederick L. Whitmer
Partner

THELEN

Thelen Reid Brown Raysman & Steiner LLP
875 Third Avenue
New York, New York 10022
212.603.2074(ofc)
212.603.2001(fax)
646.678.1451(mobile)
Fwhitmer@thelen.com

-----Original Message-----

From: Charanjit Brahma [mailto:cbrahma@kirkland.com]
Sent: Thursday, October 04, 2007 2:30 PM
To: Whitmer, Frederick
Cc: Gregg LoCascio; Ohman, John C.; JBlumenfeld@MNAT.com;
mnoreika@mnat.com
Subject: RE: Scheduling

Fred -

Not sure from your e-mail which of the extension proposals you wanted to accept. Please note that I think there is a typo in option 2 -- a 7 day extension of Siemens's deadline should make the deadline 11/5 (not 11/4). Please let us know which extension proposal you would prefer.

Regards,
Charan

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, D.C. 20005

Tel: (202) 879-5148
Fax: (202) 654-9423

"Whitmer,
Frederick
"
<FWhitmer@thelen.com>
10/04/2007 12:36 PM
To
"Gregg LoCascio"
<glocascio@kirkland.com>
cc
"Ohman, John C."
<JOhman@thelen.com>,
"Charanjit Brahma"
<cbrahma@kirkland.com>
Subject
RE: Scheduling

I'm glad I asked for the extension because we had docketed the 12th.
In
any event, I will agree to your conditions, subject to getting our
expert in those 14 days, which we should be able to do, but in any
event, very close. I will have our local counsel prepare papers.

PLEASE NOTE NEW PHONE AND FAX NUMBERS SHOWN BELOW Frederick L. Whitmer
Partner THELEN Thelen Reid Brown Raysman & Steiner LLP
875 Third Avenue
New York, New York 10022
212.603.2074(ofc)
212.603.2001(fax)
646.678.1451(mobile)
Fwhitmer@thelen.com

From: Gregg LoCascio [mailto:glocascio@kirkland.com]
Sent: Thursday, October 04, 2007 12:29 PM
To: Whitmer, Frederick
Cc: farnan@rlf.com; Ohman, John C.;
JBlumenfeld@MNAT.com; Charanjit Brahma
Subject: Re: Scheduling

Fred,

Obviously, I don't view the fact that depositions are happening next week as anything other than Saint-Gobain's decision, given that S-G waited weeks to ask for depositions and then sought dates in the first two weeks of October. That said, I am willing to agree to a request to the Court for a reasonably short extension of a few days for the same extension in exchange.

Your requested "four day" extension is actually a six-day extension as Saint-Gobain's brief is currently due 10/10. I am willing to agree to either of the following two approaches:

1. Saint-Gobain's deadline goes from 10/10 to 10/15 (5 days); Siemens goes from 10/29 to 11/2 (4 days)

OR

2. Saint-Gobain's deadline goes from 10/10 to 10/17 (7 days); Siemens goes from 10/29 to 11/4 (7 days)

Under EITHER of these proposals, the following conditions apply:

- a. Briefs and affidavits are provided by email on the due date
- b. Full paper sets and exhibits are provided by AM fedex the next day.
- c. The court needs to approve this and the submission makes clear that neither side wants the hearing date to move or thinks it needs to. Without court approval, the existing dates remain in effect obviously.
- d. We have already asked for dates to depose S-G's affiants. We want dates in the fourteen days that follow your brief's submission.

Let me know and copy Charan and Jack - thanks, Gregg

Gregg LoCascio
Kirkland & Ellis LLP
(202) 879-5290
glocascio@kirkland.com

"Whitmer, Frederick"
<FWhitmer@thelen.com>

10/04/2007 10:06 AM

To
"Gregg LoCascio"
<glocascio@kirkland.com>

cc
"Ohman, John C."
<JOhman@thelen.com>

, <farnan@rlf.com>
Subject
Scheduling

In light of the fact that the depositions are to be October 9 and 10, I propose (and request) that our reply brief and affidavits be served and filed on October 16, which represents a four day extension. Your dates would move an equal four days as well. If you agree, as I trust you will, we can submit a consent order to the court. If you don't, I intend to move for at least that much time, but I would hope that we could agree.

PLEASE NOTE NEW PHONE AND FAX NUMBERS SHOWN BELOW Frederick L. Whitmer
Partner THELEN Thelen Reid Brown Raysman & Steiner LLP
875 Third Avenue
New York, New York 10022
212.603.2074(ofc)
212.603.2001(fax)
646.678.1451(mobile)
Fwhitmer@thelen.com

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Tax Advice Disclosure: To ensure compliance with requirements imposed by the IRS, we inform you that any U.S. federal tax advice contained in this communication (including any attachments) is not intended or written to be used, and cannot be used, for the purpose of (i) avoiding penalties under the Internal Revenue Code or (ii) promoting, marketing or recommending to another party any transaction or matter addressed herein.

EXHIBIT 5

EXHIBIT NO. 5
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 6

THELEN REID BROWN
RAYSMAN & STEINER LLP
ATTORNEYS AT LAW

NEW YORK • SAN FRANCISCO • WASHINGTON, DC • LOS ANGELES
SILICON VALLEY • HARTFORD • NORTHERN NEW JERSEY • SHANGHAI

John C. Ohman
Partner
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johman@thelen.com

October 23, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP011440 – SGCP014897) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

JCO:esg
Enclosures

THELEN REID BROWN
RAYSMAN & STEINER LLP
ATTORNEYS AT LAW

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John C. Ohman
Partner
212.603.6784 Direct Dial
johman@thelen.com

October 23, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

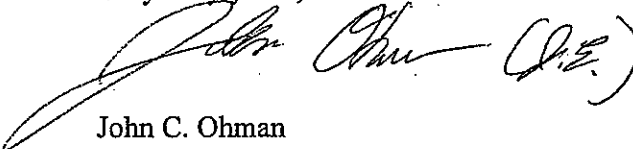
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP014898 – SGCP015982) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

EXHIBIT 7

Tracking summary

Page 1 of 2

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Detailed Results [Print](#)Select another track: 798293819527 [Next](#)

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Delivery date	Oct 25, 2007 10:27 AM	Delivered to	Mailroom
		Service type	Priority Box
		Weight	10.0 lbs.

Status Delivered**Signature image available** [Yes](#)**Signature Proof of Delivery**Click [Request copy of signature](#) to view delivery information for this shipment. [Signature Image](#)[Request copy of signature](#)

Date/Time	Activity	Location	Details
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	7:22 AM At local FedEx facility	WASHINGTON, DC	
	5:45 AM At dest sort facility	DULLES, VA	
	4:09 AM Departed FedEx location	NEWARK, NJ	
Oct 24, 2007	10:31 PM Arrived at FedEx location	NEWARK, NJ	
	7:08 PM Left origin	NEW YORK, NY	
	4:42 PM Picked up	NEW YORK, NY	
	2:13 PM Package data transmitted to FedEx		

[E-mail results](#)[Track more shipments/orders](#)[<< Track summary](#)

Subscribe to tracking updates (optional)

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E-mail address	Language	Exception updates	Delivery updates
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	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>

Select format: ☒ HTML ☐ Text ☐ Wireless

Add personal message:

Tracking summary

Page 1 of 2

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Detailed Results [Print](#)

Select another track: 790858548210 Previous | Next

Tracking number	790858548210	Reference	060349.000002/5
Signed for by	R.MASCALL		1132
Ship date	Oct 24, 2007	Destination	Washington, DC
Delivery date	Oct 25, 2007 10:27 AM	Delivered to	Mailroom
		Service type	Priority Box
		Weight	10.0 lbs.

Status Delivered

Signature image available Yes

Signature Proof of Delivery
Click **Request copy of signature** to view delivery information for this shipment.

Signature Image

[Request copy of signature](#)

Date/Time	Activity	Location	Details
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	7:36 AM	On FedEx vehicle for delivery	WASHINGTON, DC
	7:32 AM	At local FedEx facility	WASHINGTON, DC
	4:49 AM	At dest sort facility	DULLES, VA
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	9:48 PM	Left origin	NEW YORK, NY
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	7:08 PM	Left origin	NEW YORK, NY
	4:43 PM	Picked up	NEW YORK, NY
	2:10 PM	Package data transmitted to FedEx	

[E-mail results](#)[Track more shipments/orders](#)[<< Track summary](#)

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Your Name: _____

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E-mail address	Language	Exception updates	Delivery updates
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	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>

Select format: ☒ HTML ☐ Text ☐ Wireless

Add personal message:

Tracking summary

Page 1 of 2

[Close Window](#)Track Shipments/FedEx Kinko's Orders
Detailed Results [Print](#)Select another track: 791418749614 [Previous](#) | [Next](#)

Tracking number	791418749614	Reference	060349.000002/5
Signed for by	R.MASCALL		1132
Ship date	Oct 24, 2007		
Delivery date	Oct 25, 2007 10:27 AM	Destination	Washington, DC
		Delivered to	Mailroom
		Service type	Priority Box
		Weight	10.0 lbs.

Status Delivered**Signature image available** [Yes](#)**Signature Proof of Delivery**Click [Request copy of signature](#) to view delivery information for this shipment.

Signature Image

[Request copy of signature](#)

Date/Time	Activity	Location	Details
Oct 25, 2007	10:27 AM Delivered	Washington, DC	
	7:31 AM On FedEx vehicle for delivery	WASHINGTON, DC	
	7:15 AM At local FedEx facility	WASHINGTON, DC	
	5:45 AM At dest sort facility	DULLES, VA	
	4:09 AM Departed FedEx location	NEWARK, NJ	
Oct 24, 2007	10:31 PM Arrived at FedEx location	NEWARK, NJ	
	7:08 PM Left origin	NEW YORK, NY	
	4:43 PM Picked up	NEW YORK, NY	
	2:14 PM Package data transmitted to FedEx		

[E-mail results](#)[Track more shipments/orders](#)[<< Track summary](#)

Subscribe to tracking updates (optional)

Your Name: _____

Your E-mail Address: _____

E-mail address	Language	Exception updates	Delivery updates
_____	English	<input type="checkbox"/>	<input type="checkbox"/>
_____	English	<input type="checkbox"/>	<input type="checkbox"/>
_____	English	<input type="checkbox"/>	<input type="checkbox"/>
_____	English	<input type="checkbox"/>	<input type="checkbox"/>

Select format: ☒ HTML ☐ Text ☐ Wireless

Add personal message:

Tracking summary

Page 1 of 2

[Close Window](#)Track Shipments/FedEx Kinko's Orders
Detailed Results [Print](#)

Tracking number	791418744726	Reference	060349.000002/5
Signed for by	R.MASCALL		1132
Ship date	Oct 24, 2007		
Delivery date	Oct 25, 2007 10:27 AM	Destination	Washington, DC
		Delivered to	Mailroom
		Service type	Priority Box
		Weight	10.0 lbs.

Status Delivered**Signature image available** [Yes](#)**Signature Proof of Delivery**Click **Request copy of signature** to view delivery information for this shipment.

Signature Image

[Request copy of signature](#)

Date/Time	Activity	Location	Details
Oct 25, 2007	10:27 AM Delivered	Washington, DC	
	7:35 AM On FedEx vehicle for delivery	WASHINGTON, DC	
	7:32 AM At local FedEx facility	WASHINGTON, DC	
	4:49 AM At dest sort facility	DULLES, VA	
Oct 24, 2007	11:33 PM Departed FedEx location	NEWARK, NJ	
	9:48 PM Left origin	NEW YORK, NY	
	9:09 PM Arrived at FedEx location	NEWARK, NJ	
	7:08 PM Left origin	NEW YORK, NY	
	4:43 PM Picked up	NEW YORK, NY	
	2:11 PM Package data transmitted to FedEx		

[E-mail results](#)[Track more shipments/orders](#)[<< Track summary](#)

Subscribe to tracking updates (optional)

Your Name: _____

Your E-mail Address: _____

E-mail address	Language	Exception updates	Delivery updates
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>

Select format: ☒ HTML ☐ Text ☐ Wireless

Add personal message:

Tracking summary

Page 1 of 2

[Close Window](#)Track Shipments/FedEx Kinko's Orders
Detailed Results [Print](#)

Tracking number	790858552304	Reference	060349.000002/5
Signed for by	R.MASCALL		1132
Ship date	Oct 24, 2007		
Delivery date	Oct 25, 2007 10:27 AM	Destination	Washington, DC
		Delivered to	Mailroom
		Service type	Priority Box
		Weight	10.0 lbs.

Status Delivered**Signature image available** [Yes](#)**Signature Proof of Delivery**Click **Request copy of signature** to view delivery information for this shipment. [Signature Image](#)[Request copy of signature](#)

Date/Time	Activity	Location	Details
Oct 25, 2007	10:27 AM Delivered	Washington, DC	
	7:33 AM On FedEx vehicle for delivery	WASHINGTON, DC	
	7:30 AM At local FedEx facility	WASHINGTON, DC	
	4:49 AM At dest sort facility	DULLES, VA	
Oct 24, 2007	11:33 PM Departed FedEx location	NEWARK, NJ	
	9:48 PM Left origin	NEW YORK, NY	
	9:09 PM Arrived at FedEx location	NEWARK, NJ	
	7:08 PM Left origin	NEW YORK, NY	
	4:43 PM Picked up	NEW YORK, NY	
	2:12 PM Package data transmitted to FedEx		

[E-mail results](#)[Track more shipments/orders](#)[<< Track summary](#)

Subscribe to tracking updates (optional)

Your Name: _____

Your E-mail Address: _____

E-mail address	Language	Exception updates	Delivery updates
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>
	English	<input type="checkbox"/>	<input type="checkbox"/>

Select format: ☒ HTML ☐ Text ☐ Wireless

Add personal message:

EXHIBIT 8

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John C. Ohman
Partner
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johman@thelen.com

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October 24, 2007

Federal Express

Charanjit Brahma, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

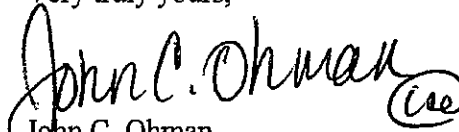
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP015983 – SGCP019064) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

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October 24, 2007

Federal Express

Charanjit Brahma, Esq.
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655 Fifteenth Street, N.W.
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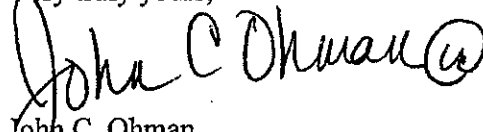
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP019065 – SGCP022039) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

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October 24, 2007

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655 Fifteenth Street, N.W.
Washington, DC 20005

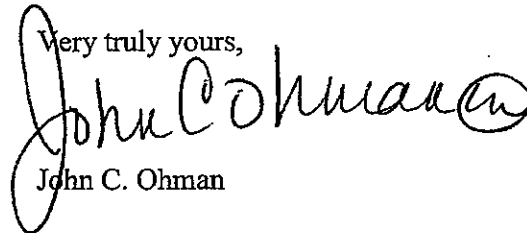
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP022040 – SGCP024624) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

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Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

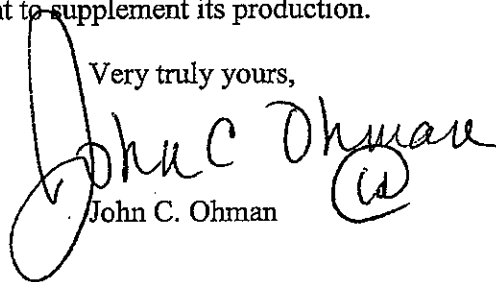
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP024625 – SGCP027894) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

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October 24, 2007

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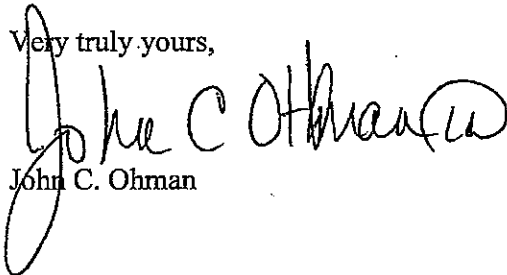
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP027895 – SGCP028357) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

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EXHIBIT 9

THELEN REID BROWN
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ATTORNEYS AT LAW

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October 30, 2007

Federal Express

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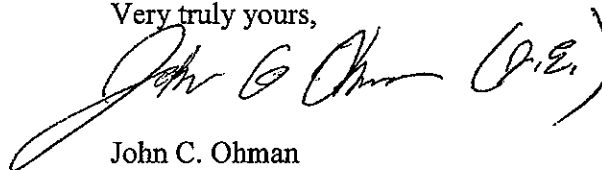
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP028368 – SGCP030774) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



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October 30, 2007

Federal Express

Charanjit Brahma, Esq.
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655 Fifteenth Street, N.W.
Washington, DC 20005

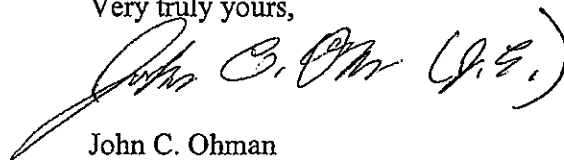
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP030775 – SGCP033279) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

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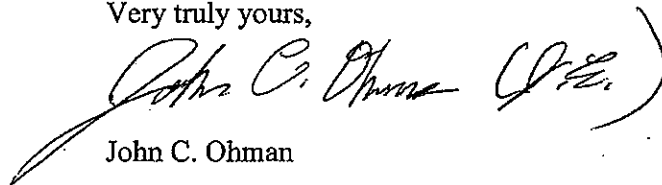
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP033280 – SGCP035718) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

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October 30, 2007

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Washington, DC 20005

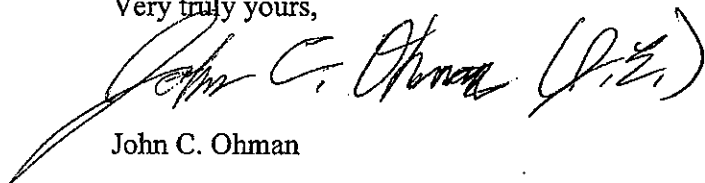
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP035719 – SGCP038531) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

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October 30, 2007

Federal Express

Charanjit Brahma, Esq.
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Washington, DC 20005

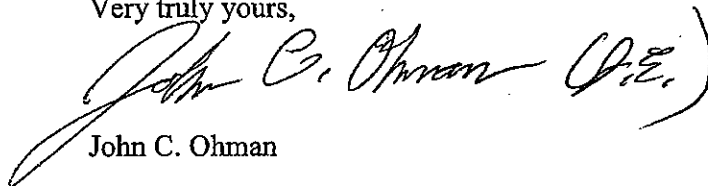
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP038532 – SGCP041190) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,



John C. Ohman

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October 30, 2007

Federal Express

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Washington, DC 20005

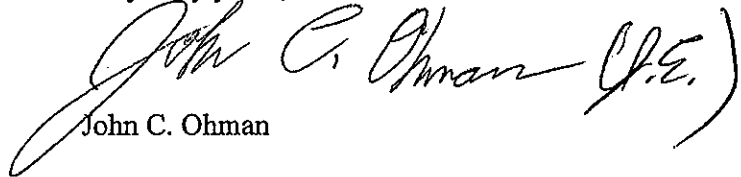
Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Charan:

Enclosed are additional documents (Bates Nos. SGCP041191 – SGCP041536) that are responsive to Plaintiff's First Set of Requests for Production of Documents. The documents are being provided to you subject to the terms of the Stipulated Protective Order effective September 26, 2007.

Defendant reserves the right to supplement its production.

Very truly yours,


John C. Ohman

JCO:esg
Enclosures

EXHIBIT 10

THELEN REID BROWN
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A THOMSON COMPANY

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November 1, 2007

Federal Express and Electronic Mail

Gregg LoCascio, Esq.
Kirkland & Ellis LLP
655 Fifteenth Street, N.W.
Washington, DC 20005

Re: Siemens Medical Solutions USA, Inc. v. Saint-Gobain Ceramics
& Plastics, Inc. (D. Del. C.A. No. 07-190-SLR)

Dear Gregg:

I am writing by way of follow-up to your telephone conference with Fred Whitmer yesterday regarding defendant's document production in this case.

Despite our best efforts to complete our document production before the deposition of Michael Mayhugh on October 24, 2007, we were unable to do so, due in large part to our receipt in early October of a diskette containing over 215,000 pages of documents culled from French sources. Difficulties with the firm's document management vendors complicated matters further. As a result, we have continued to produce potentially responsive documents, with a shipment of some 13,000 pages sent to Kirkland & Ellis on October 24th and another 13,000 or so sent out the day before yesterday. We anticipate completing Saint-Gobain's production by next Monday.

While we certainly wish that we had been able to complete our production sooner, we don't think that plaintiff has been prejudiced by Saint-Gobain's late production inasmuch as we are willing (1) to make Dr. Mayhugh available for further deposition as well as (2) to join in an application to extend plaintiff's time to serve and file its reply papers in further support of its pending preliminary injunction motion. Inasmuch as you have indicated that plaintiff doesn't want such an extension, we are willing to consent to plaintiff's submission of supplemental motion papers, if it so wishes to file them, after being afforded a reasonable time to review Saint-Gobain's remaining document production and take additional testimony from Dr. Mayhugh.

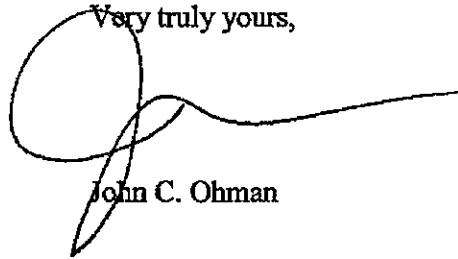
Your request that we withdraw Dr. Mayhugh's declaration from our preliminary injunction opposition papers, however, would have a grossly disproportionate effect compared to

Page 2

whatever inconvenience our late production may have caused plaintiff and is completely unwarranted and unacceptable.

Please let us know how plaintiff intends to proceed.

Very truly yours,

A handwritten signature in black ink, consisting of a large, loopy initial 'J' followed by a long, horizontal, slightly wavy line extending to the right.

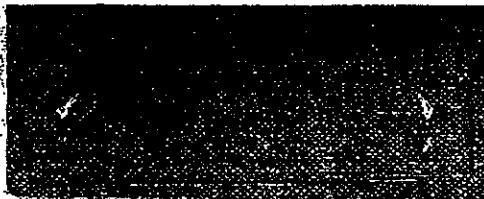
John C. Ohman

JCO:esg

Cc: Frederick L. Whitmer

NY #1205191 v1

EXHIBIT 11



Interference No. : 105083
Volume No. : 1
Paper No. : _____

Related Interferences

MEDLEY

API Name

DISTRIBUTED

JUN 13 2003

INTERFERENCE PROCEEDING

before the

Board of Patent Appeals and Interferences

Technology Center

2800

INTERFERENCE NO. **105083**

(SHEET _____)

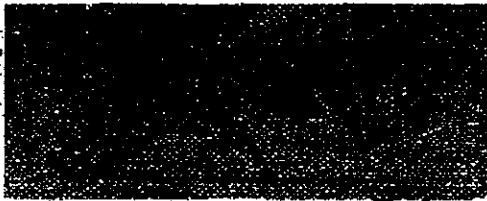
- 1 FEB 11 2003 Notice Acknowledgment
- 2 FEB 11 2003 Standing Order
- 3 Feb 20, 03 - Reg. For File Copies - McCallan
- 4 March 3, 03 - Designation of Lead Backup Counsel - McCallan
- 5 March 3, 03 - Designation of Lead Party of Interest - McCallan
- 6 March 3, 03 - Clean Copy of Claims - McCallan
- 7 March 6, 03 - File Copy Request - Chair
- 8 March 7, 03 - Designation of Lead Backup Counsel - Chair
- 9 March 7, 03 - Designation of Lead Party of Interest - Chair
- 10 March 7, 03 - Designation of Non-Interested Party of Note - Chair
- 11 March 7, 03 - Clean Copy of Claims - Chair
- 12 March 7, 03 - Submission of Assignee's PLA - Chair
- 13 Mar 10, 03 ORDER Files Sent to CPL
- 14 March 28, 03 - Submission of Claims w/ Drawing References - Chair
- 15 March 28, 03 - Rule 633 Preliminary Motions - Chair
- 16 March 28, 03 - Correction of Clean Copy of Claims 4 - Chair
- 17 Apr. 8, 03 ORDER Setting Trial
- 18 April 25, 03 - Reg. For Entry of Adverse Judgment - McCallan
- 19 Apr 28, 03 Judgment awarded to CHAI
- 20 May 1, 03 - Reg. To Keep Separate under 35 USC 135c - Chair
- 21 May 6, 03 Acknowledgment of Bill of Materials
- 2
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MCCLELLAN
■ PN 6,323,489

v.

CHAI
et al.
SN 9/506,160



Interference No. : 1 0 5 0 8 3
Volume No. : 2
Paper No. : _____

Related Interferences

MEDLEY

API Name

INTERFERENCE PROCEEDING

before the

Board of Patent Appeals and Interferences

Technology Center

2800

Interference No.: 105083

Volume Index

[illegible]

INTERFERENCE INITIAL MEMORANDUM

Count # 1

To the Board of Patent Appeals and Interferences:

An interference is proposed involving the following 2 parties

PARTY + CHAI	APPLICATION NO. 09/506,160	FILING DATE 17 February 2000	PATENT NO., IF ANY	ISSUE DATE, IF ANY
If the involved case is a patent, have its maintenance fees been paid? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not due yet				
Proposed priority benefit (list all intervening applications necessary for continuity):				
COUNTRY	APPLICATION NO.	FILING DATE	PATENT NO., IF ANY	ISSUE DATE, IF ANY
US	60/120,500	18 February 1999		
The claim(s) of this party corresponding to this count:				
PATENTED OR PATENTABLE PENDING CLAIMS 1,4,5 and 7-20			UNPATENTABLE PENDING CLAIMS	
The claim(s) of this party NOT corresponding to this count:				
PATENTED OR PATENTABLE PENDING CLAIMS			UNPATENTABLE PENDING CLAIMS	
PARTY + McCALLON	APPLICATION NO. 09/326,056	FILING DATE 04 June 1999	PATENT NO., IF ANY US006323489B1	ISSUE DATE, IF ANY 27 November 2001
If the involved case is a patent, have its maintenance fees been paid? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not due yet				
Proposed priority benefit (list all intervening applications necessary for continuity):				
COUNTRY	APPLICATION NO.	FILING DATE	PATENT NO., IF ANY	ISSUE DATE, IF ANY
The claim(s) of this party corresponding to this count:				
PATENTED OR PATENTABLE PENDING CLAIMS 1-10			UNPATENTABLE PENDING CLAIMS	
The claim(s) of this party NOT corresponding to this count:				
PATENTED OR PATENTABLE PENDING CLAIMS			UNPATENTABLE PENDING CLAIMS	
(Check off each step, if applicable) INSTRUCTIONS				
<input checked="" type="checkbox"/> 1. Obtain all files listed above. <input checked="" type="checkbox"/> 2. Confirm that the proposed involved claims are still active and all corrections and entered amendments have been considered. The patents must not be expired for, among other things, failure to pay a maintenance fee (Check PALM screen 2970). <input checked="" type="checkbox"/> 3. If one of the involved files is a published application or a patent, check for compliance with 35 U.S.C. 135(b). <input checked="" type="checkbox"/> 4. Obtain a certified copy of any foreign benefit documents where necessary (37 CFR 1.55(a)). <input type="checkbox"/> 5. Discuss the proposed interference with an Interference Practice Specialist in your Technology Center.				
DATE 03 January 2003	PRIMARY EXAMINER (Signature) <i>INSTANT</i>		ART UNIT 2878	TELEPHONE NO. (703)308-4850
DATE 1/23/05	INTERFERENCE PRACTICE SPECIALIST OR TECHNOLOGY CENTER DIRECTOR (signature) <i>Ed Glick</i>		TELEPHONE NO. 703-308-4858	

Proposed interference:
 09/506,160 and US Patent 6,323,489
 Art Unit: 2878

Page: 2

THE COUNT

Claim 1 of Application Number 09/506,160 (Party 1)

or

Claim 1 of U.S. Patent Number 6,323,489 (Party 2)

Claim 1 of Party 1 recites a scintillator ~~detector for high energy radiation~~ comprising a ~~monocrystalline structure~~ of cerium doped lutetium yttrium orthosilicate with the formula $Ce_{2x}(Lu_{1-y}Y_y)_{2(1-x)}SiO_5$ where x is in the range from approximately 0.00001 [10^{-5}] to approximately 0.05 and y is in the range from approximately 0.0001 [10^{-4}] to approximately 0.9999. Accordingly, it differs from claim 1 of Party 2 in setting forth the purpose of the scintillator as a detector, in reciting it as a "monocrystalline structure" rather than "single crystal," in using the term "doped" rather than "activated," in reciting it as an "orthosilicate" rather than an "oxyorthosilicate," and in the expression of the molecular formula and the ranges of the atomic components. Claim 1 of Party 2 also recites that the scintillator is "transparent." These differences are addressed as follows:

It would have been obvious that the scintillator recited by Party 1 was "transparent" as recited by Party 2 because a scintillator which is not transparent to its scintillations is not useful, as it is a requirement that the light generated in the scintillator by the impingement of high energy radiation leave the scintillator for detection, measurement, and study. Furthermore, it is inherent that a "scintillator" is a detector of high energy radiation, as the principle of scintillation which describes the material occurs only in the presence of high energy radiation and so serves as a detector thereof, so Party 2 need not recite this. A "single crystal" and "monocrystalline" mean the same thing in the art of scintillators, so this word choice does not represent a difference in the scope of the claimed subject matter between the parties. The same is true of "doped" and "activated." As is made more clear below, since the molecular formulas are the same despite their different expression, the choice of Party 2 to recite an oxyorthosilicate rather than an orthosilicate as Party 1 has done does not represent a difference in the scope of the claimed subject matter between the parties.

The molecular formula of Party 1 is $Ce_{2x}(Lu_{1-y}Y_y)_{2(1-x)}SiO_5$. The molecular formula of Party 2 is $Lu_{(2-x-z)}Y_zCe_zSiO_5$. As a preliminary, note that the amount of SiO_5 is the same in each formula. Let the 2x of Party 1 equal to the z of Party 2 so that the amount of cerium (Ce) retains a 1:1 proportion to the amount of SiO_5 . Expanding the subscript for yttrium (Y) in the formula of Party 1 there is obtained the expansion $2y(1-x)$ which multiplies out to $2y-2xy$. Making the substitution $2x=z$ as done previously for cerium, the subscript for yttrium simplifies to $2y-zy$ which can be rearranged as $(2-z)y$. Let the $(2-z)y$ of Party 1 equal to the x of Party 2 so that the amount of yttrium retains a 1:1 proportion to the amount of SiO_5 . Expanding the subscript for lutetium (Lu) in the formula of Party 1 there is obtained the expansion $2(1-x)(1-y)$ which multiplies out to $2-2x-2y+2xy$. Making the substitution $2x=z$ as done previously for cerium, the subscript for lutetium simplifies to $2-z-2y+zy$ which can be rearranged as $2-z-(2-z)y$. Making the substitution $(2-z)y$ as done previously for yttrium, the subscript for lutetium simplifies to $2-z-x$, which is the subscript for Lu found in the expression of Party 2. Accordingly, the molecular formula in both claims is the same despite the different expressions.

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Taking the range for cerium in Party 1 ($0.00001 \leq x \leq 0.05$) and multiplying by 2 in view of the substitution made above ($2x=z$) results in a range from 0.00002 to 0.1. This range encompasses the range for cerium of Party 2 ($0.001 \leq z \leq 0.02$) and thus the ranges are anticipated or made obvious in view of each other under the principles set forth in MPEP §§ 2131.03 and 2144.05.

The range for yttrium in Party 2 is ($0.05 \leq x \leq 1.95$). The corresponding range for yttrium in Party 1 is a result of the subscript $y \cdot 2(1-x)$. Feeding this subscript the allowed values for the ranges which x and y can take in Party 1 results in the range $.000199999 \leq y \cdot 2(1-x) \leq 1.89981$ which overlaps the range of Party 2 and thus the ranges are anticipated or made obvious in view of each other under the principles set forth in MPEP §§ 2131.03 and 2144.05.

The range for lutetium in Party 1 and in Party 2 is from a minimum which is very small (less than 0.05 in both parties) to a maximum which is nearly 2 (greater than 1.9 in both parties). Accordingly, it is considered that the ranges are anticipated or made obvious in view of each other under the principles set forth in MPEP §§ 2131.03 and 2144.05.

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The claims 1, 4, 5, and 7-20 of Party 1 (09/506,160) correspond to the count.

Claim 1 of Party 1 is identical to the count. The ranges expressed in claim 4 of Party 1 limit the values of x and y, and so are anticipated or made obvious by the count. Claim 5 of Party 1, an independent claim, adds to a cerium doped lutetium yttrium orthosilicate mono crystal a coupled photodetector which would generate an electrical signal upon receiving the scintillation created in response to a high energy gamma ray. Such a combination of scintillator (anticipated or made obvious by the scintillator of claim 1) and photodetector is entirely routine in the art of detecting high energy radiation, and corresponds to independent claims 5 and 8 of Party 2. Claim 7 of Party 1 adds to the combination of claim 5 the molecular formula and specific values of x and y previously recited in claim 1. Claim 8 of Party 1 limits the values of x and y in the combination of claim 7 in the same way that claim 4 does. Claim 9 of Party 1 recites a Markush group of typical photodetectors, one or more of which it would have been obvious to identify as the photon detector in the combination of claim 5. Claim 10 of Party 1, an independent claim, recites a method of detecting energy with a scintillation detector which comprises the steps of receiving energy by a crystal comprising cerium doped lutetium yttrium orthosilicate and detecting energy (that is, the scintillations created thereby) from a detector coupled to the crystal. It would have been obvious to use the scintillator detector of claim 1 in such a method since it is a typical way of using such scintillation crystals. Claims 11, 12, and 13 of Party 1 specify the "energy" detected by the method, one skilled in the art is aware of what types of high energy radiation may be detected with a scintillator detector. Claim 14 of Party 1 recites that the step of receiving radiation includes "a monocrystalline" which would have been obvious since claim 1 recites a monocrystalline structure and because polycrystalline structures are less efficient for this purpose. Claim 15 of Party 1 recites that the detecting step occurs with a coupled photodetector, such a combination of scintillator and photodetector is entirely routine in the art of detecting high energy radiation. Claims 16, 17, and 18 of Party 1 recite typical photodetectors, one or more of which it would have been obvious to identify as the photodetector in the combination of claim 15. Claim 19 of Party 1 adds to the combination of steps in claim 10 the molecular formula and specific values of x and y previously recited in claim 1. Claim 20 of Party 1 limits the values of x and y in the combination of steps in claim 10 in the same way that claim 4 does.

No claim of Party 1 includes a means or step for performing a function within the meaning of 35 U.S.C. 112, sixth paragraph.

See for example Melcher (US004958080A) already of record in Party 1 as evidence of the obviousness of modifying a scintillator by combining it with a photodetector and the purpose of detecting high energy radiation with the combination.

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The claims 1-10 of Party 2 (09/326,056) correspond to the count.

Claim 1 of Party 2 is identical to the count. The range expressed in claim 2 of Party 2 limits the value of x , and so is anticipated or made obvious by the count. The luminescence wavelength recited in claim 3 of Party 2 is anticipated or made obvious by the principle of inherency in the composition, see MPEP § 2112. The luminescence decay time recited in claim 4 of Party 2 is anticipated or made obvious by the principle of inherency in the composition, see MPEP § 2112. Claim 5 of Party 2, an independent claim, adds to the crystal scintillator of claim 1 a coupled photodetector for detecting light which would be created in response to radiation. Such a combination of scintillator and photodetector is entirely routine in the art of detecting high energy radiation, and corresponds to independent claim 5 of Party 1. Claims 6 and 7 of Party 2 recite typical photodetectors, one or more of which it would have been obvious to identify as the photodetector in the combination of claim 5. The ranges expressed in claim 8 of Party 2 limit the values of x and z , and so are anticipated or made obvious by the count. Claims 9 and 10 of Party 2 recite the same species of photodetectors that claim 6 and 7 do.

No claim of Party 2 includes a means or step for performing a function within the meaning of 35 U.S.C. 112, sixth paragraph.

See for example Takagi *et al.* (US004647781A) already of record in Party 2 as evidence of the obviousness of modifying a scintillator by combining it with a photodetector and the purpose of detecting high energy radiation with the combination.

EXHIBIT 12

EXHIBIT NO. 12

HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 13

EXHIBIT NO. 13
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 14

EXHIBIT NO. 14
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 15

1 UNITED STATES DISTRICT COURT
2 DISTRICT OF DELAWARE

3 SIEMENS MEDICAL SOLUTIONS USA, INC.,

4 Plaintiff,

5 vs. No. 07-190 (SLR)

6 SAINT-GOBAIN CERAMICS & PLASTICS, INC.,

7 Defendant.

8

9 VIDEOTAPED DEPOSITION OF KENNETH J. McCLELLAN

November 2, 2007

10 8:47 a.m.

Courtyard by Marriott

11 3347 Cerrillos Road

Santa Fe, New Mexico

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PURSUANT TO THE FEDERAL RULES OF CIVIL
15 PROCEDURE, this deposition was:

16

TAKEN BY: CHARANJIT BRAHMA

17 ATTORNEY FOR PLAINTIFF

18

REPORTED BY: DEBORAH L. O'CONNOR, RPR, CRR, CCR #297

19 BEAN & ASSOCIATES, INC.

Professional Court Reporting Service

20 500 Marquette, NW, Suite 280

Albuquerque, New Mexico 87102

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1 be some variation?

2 A. As I said, numbers that I can recall and
3 that there is an example of one here, is I thought
4 it was 5 to 7 percent.

5 Q. The property of afterglow, is that
6 something that is an important characteristic in the
7 context of PET scanning?

8 A. I do not know the design specifications of
9 the PET detector. But my understanding that is from
10 the reading that I have done that that is a
11 parameter that they consider, yes. The relative
12 weight of that parameter, I do not know.

13 Q. Okay. And both LYSO and LSO cerium
14 activated have some level of afterglow, correct?

15 A. That's correct.

16 Q. So in a PET scanning application, is there
17 something that's done within the context of the
18 overall edirector to compensate for afterglow?

19 A. Again, I do not know the specifics of the
20 various PET detector designs so I won't know
21 software or algorithmss or anything like that.

22 Q. And again you wouldn't be able to tell
23 whether a difference between 10 and 15 percent
24 afterglow versus 5 to 7 percent afterglow would be
25 significant in the context of PET scanning

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1 detectors, correct?

2 A. I would not know that for a PET detector,
3 that's correct.

4 Q. Let's move to maybe an application that
5 you do know more about, the DARHT. In that context
6 was afterglow an important property that you were
7 concerned with?

8 A. Yes.

9 Q. And in that context was it significant
10 that cerium activated LSO had an afterglow of
11 somewhere between 10 and 15 percent whereas the
12 10 percent Y LYSO that you tested was shown to have
13 afterglow in the range of 5 to 7 percent?

14 A. Yes.

15 Q. How is it important?

16 A. The term that I mentioned before was
17 ghosting. So the -- it increases the background
18 from one image to the next during this flash
19 radiography system. So, yes, it was very important
20 for that.

21 Q. And you used the term background there and
22 I guess that's why I might have been confused
23 earlier about the difference between afterglow and
24 background. I think you described background to you
25 was light output that was caused by a radioactive

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1 that's all based on your work at Los Alamos, is that
2 right?

3 A. That's correct.

4 Q. Is there any other work you've done
5 outside of your work at Los Alamos that relates to
6 scintillator crystals?

7 A. No.

8 Q. Okay. And just to be clear, the
9 scintillator crystals that you worked on, did you
10 work on any of those in the context of applications
11 for PET scanning?

12 A. We were always aware that that was one of
13 the applications but, no, we were not developing
14 anything specifically targeting PET scanning.

15 MR. WHITMER: What numbers did you read
16 before? 1450 and 1451?

17 MR. BRAHMA: Yeah.

18 MR. WHITMER: I didn't keep them in mind.

19 Q. (By Mr. Brahma) Now, with respect to your
20 declaration, were there drafts of that declaration
21 made?

22 A. No, it was a continuous document.

23 Q. So when you say it was -- there were no
24 drafts, it was a continuous document, you mean that
25 you kept writing over the same electronic file?

EXHIBIT 16

EXHIBIT NO. 16
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 17

LEXSEE

**A & L TECHNOLOGY, Plaintiff, v. RESOUND CORPORATION, Defendant. AND
RELATED COUNTERCLAIM.**

No. C 93-00107 CW

**UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF
CALIFORNIA**

1995 U.S. Dist. LEXIS 22443

March 10, 1995, Decided

March 10, 1995, Filed

SUBSEQUENT HISTORY: Injunction granted at, Stay granted by, Motion denied by *A & L Tech. v. Resound Corp.*, 1995 U.S. Dist. LEXIS 22442 (N.D. Cal., Mar. 15, 1995)

COUNSEL: [*1] For A & L Technology, Plaintiff: Janet L. Cullum, Paul A. Renne, Cooley Godward LLP, Palo Alto, CA; Michael Barclay, Wilson Sonsini Goodrich & Rosati, Palo Alto, CA.

For Resound Corp., Defendant: Robert P. Taylor, Howrey Simon Arnold & White LLP, Menlo Park, CA.

For Resound Corp., Counter-claimant: Robert P. Taylor, Howrey Simon Arnold & White LLP, Menlo Park, CA.

For A & L Technology, Counter-defendant: Michael Barclay, Wilson Sonsini Goodrich & Rosati, Palo Alto, CA; Janet L. Cullum, Paul A. Renne, Cooley Godward LLP, Palo Alto, CA.

JUDGES: CLAUDIA WILKEN, UNITED STATES DISTRICT JUDGE.

OPINION BY: CLAUDIA WILKEN

OPINION

**MEMORANDUM OF DECISION DENYING
DEFENDANT'S MOTION FOR SUMMARY JUDGMENT
OF NON-INFRINGEMENT, AND GRANTING
PLAINTIFF'S MOTIONS FOR SUMMARY**

**ADJUDICATION ON VALIDITY, INEQUITABLE
CONDUCT, ESTOPPEL, LACHES AND FAILURE TO
JOIN**

On December 16, 1994, the Court heard oral argument on the parties' cross motions for summary judgment. Having fully considered the papers and oral argument of counsel, and good cause appearing, the Court DENIED Defendant's motion on infringement, and GRANTED Plaintiff's motions on invalidity and inequitable conduct, estoppel, laches and failure [*2] to join, for the reasons that follow.

BACKGROUND

Plaintiff's patent for an advanced hearing aid was issued in 1983. *U.S. Patent 4,396,806* ("the '806 patent"). Sometime thereafter, Plaintiff learned of ReSound's potentially infringing hearing aid. Following fruitless settlement negotiations, ReSound petitioned successfully for reexamination of the patent. The PTO's reexamination certificate, issued in 1992, confirmed the patentability of claims 1, 2, 3, 5 and 6, and allowed claim 4 as amended. In the present action, Plaintiff claims ReSound's hearing aids infringe claims 1 and 2 of the '806 patent.

The '806 patent discloses a "hearing aid amplifier." The patented invention splits incoming sounds into two or more analog frequency bands, or "channels." The sound characteristics within each frequency channel are modified to meet the needs of the individual patient through compression and amplification. A digital programmable read-only memory ("PROM"), stores the patient's individual "prescription," a digital code

establishing the frequency at which the channels are divided and the nature of compression and amplification in each channel. The PROM is "coupled" to signal processing [*3] circuitry which controls the analog components operating the compression and amplification.

ReSound's hearing aids are in two generations. Plaintiff asserts that both generations infringe the '806 patent. In each generation, incoming sounds are split into two frequency channels, and a digital prescription controls compression and amplification. ReSound's hearing aids use three integrated circuits or "chips": (1) the "electrically erasable and programmable read only memory" ("EEPROM"), which stores the prescription, (2) the digital operations controller ("DOC"), and (3) the bipolar information processor ("BIP"). The EEPROM is coupled to intermediate circuitry, i.e., a shift register and logic element known as "latches" on the DOC chip, and the latches in turn are coupled to the analog circuitry on the BIP chip. In ReSound's first generation hearing aids, the EEPROM was located in a remote "pen" which fed the prescription ultrasonically to the hearing aid, the device that fit in or behind a patient's ear, where the prescription was temporarily stored in the DOC's latches. Each time the hearing aid was turned off, the prescription was lost, and the patient had to re-input the prescription [*4] with the pen upon turning the hearing aid back on. The pen could also contain an alternate prescription program, which the patient could choose to input rather than the primary prescription. In the second generation, the EEPROM was added to the hearing aid itself, rendering use of the pen optional. The EEPROM in the second generation operates the same way as it did in the pen, i.e., it transfers the prescription to the latches, which temporarily store it while the battery is on. In the present motion, Defendant, apparently for the first time refers to the DOC latches as "digital CMOS memory" or "CMOS latches."¹

¹ CMOS stands for "complimentary metal oxide semiconductor," which refers to the manufacturing technique for making this kind of chip.

LEGAL STANDARD FOR SUMMARY JUDGMENT

Summary judgment is properly granted when no genuine and disputed issues of material fact remain, or, when viewing the evidence most favorably to the non-moving party, the movant is clearly entitled to

prevail as a matter [*5] of law. *Fed. R. Civ. P.* 56; *Celotex Corp. v. Catrett*, 477 U.S. 317, 322-23, 106 S. Ct. 2548, 91 L. Ed. 2d 265 (1986); *Eisenberg v. Insurance Co. of North America*, 815 F.2d 1285, 1288-89 (9th Cir. 1987).

The moving party bears the burden of showing that there is no material factual dispute. Therefore, the Court must regard as true the opposing party's evidence, if supported by affidavits or other evidentiary material. *Celotex*, 477 U.S. at 324; *Eisenberg*, 815 F.2d at 1289. The Court must draw all reasonable inferences in favor of the party against whom summary judgment is sought. *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587, 106 S. Ct. 1348, 89 L. Ed. 2d 538 (1986); *Intel Corp. v. Hartford Acc. & Indem. Co.*, 952 F.2d 1551, 1558 (9th Cir. 1991).

Material facts which would preclude entry of summary judgment are those which, under applicable substantive law, may affect the outcome of the case. The substantive law will identify which facts are material. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248, 106 S. Ct. 2505, 91 L. Ed. 2d 202 (1986).

A party moving for summary judgment may prevail by pointing out [*6] the "absence of evidence to support the nonmoving party's case" with respect to an issue on which the nonmovant bears the burden. *Celotex*, 477 U.S. at 325. In a patent case, the patentee bears the burden of proving infringement. *Wilson Sporting Goods Co. v. David Geoffrey & Assoc.*, 904 F.2d 677, 685 (Fed. Cir.), cert. denied, 498 U.S. 992, 111 S. Ct. 537, 112 L. Ed. 2d 547 (1990). Accordingly, if the patentee does not produce evidence of infringement sufficient to raise a triable issue of fact, summary judgment must be granted in the moving party's favor. *Intellicall, Inc. v. Phonometrics, Inc.*, 952 F.2d 1384, 1389 (Fed. Cir. 1992).

DEFENDANT'S MOTION FOR SUMMARY JUDGMENT OF NON-INFRINGEMENT

Determination of whether a claim has been infringed is a two-step analysis. First, the claim must be properly construed to determine its scope and meaning; second, the claim as properly construed must be compared to the accused device. *Carroll Touch v. Electro Mech. Systems*, 15 F.3d 1573, 1576 (Fed. Cir. 1993). Claim interpretation is a question of law, *Carroll Touch*, 15 F.3d at 1577; determining whether the claim as [*7] interpreted "reads on" or "covers" the alleged infringer's

product is a question of fact. *Cf. Standard Oil Co. v. American Cyanamid Co.*, 774 F.2d 448, 452-53 (Fed. Cir. 1985). A claim covers an accused device if the device embodies every limitation of the claim, either literally or by an equivalent. *Carroll Touch*, 15 F.3d at 1576.

To construe a claim, the Court must examine the claim language, the patent specification, and the prosecution history. *Carroll Touch*, 15 F.3d at 1577; *Read Corp. v. Portec, Inc.*, 970 F.2d 816, 823 (Fed. Cir. 1992). Claims should be construed as they would be by those skilled in the art, and expert testimony may be helpful regarding how those skilled in the art would interpret the claims. *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 867 (Fed. Cir. 1985); *Fonar Corp. v. Johnson & Johnson*, 821 F.2d 627, 631 (Fed. Cir. 1987), cert. denied, 484 U.S. 1027, 108 S. Ct. 751, 98 L. Ed. 2d 764 (1988).

A disputed issue of fact may arise in connection with interpretation of a term in a claim if there is a genuine evidentiary conflict created by the underlying probative evidence [*8] pertinent to the claim's interpretation. *Brooktree Corp. v. Advanced Micro Devices*, 977 F.2d 1555, 1577 (Fed. Cir. 1993). In such cases, the jury must interpret the claim. *Id.*; *Palumbo v. Don-Joy Co.*, 762 F.2d 969, 974 (Fed. Cir. 1985).

Plaintiff claims that ReSound's hearing aids infringe claims 1 and 2. Since claim 2 is dependent on claim 1, the parties have focused only on certain elements of claim 1.

Claim 1 of the '806 patent describes the digital memory as follows:

a compact monolithic digital memory means comprising a programmable read only memory (PROM) operative to store binary states in bit storage cells **without electrical power input**, said binary states being **permanently presettable** external of said apparatus

Ritchey Opp. Decl. re: infringement Exh. 3 (Col.8:1-34) (emphasis added).

Defendant asserts that ReSound's CMOS latches, rather than its EEPROM, is the equivalent of the '806 patent's PROM. The CMOS latches receive the prescription from the EEPROM each time the hearing aid

is turned on; the prescription is lost whenever the battery is turned off. Thus, Defendant argues that the latches cannot store [*9] the prescription "without electrical power input." Further, because the CMOS memory is erasable and reprogrammable (indeed, it is reprogrammed every time the hearing aid is turned on), it cannot be "permanently presettable." Whether the EEPROM can be considered a part of ReSound's hearing aid turns on the meaning of the word "coupled," which appears in other elements of claim 1.

Alternatively, Defendant argues that even if the EEPROM is considered its device's digital memory, it cannot infringe claim 1 because the EEPROM also is not "permanently presettable." In support of these arguments, Defendant relies upon expert interpretation of statements made during the prosecution and reexamination history of the '806 patent. Plaintiff has not cross-moved for summary judgment on claim construction and infringement issues.

Having carefully considered all evidence submitted, the Court finds that disputed issues of material fact exist as to whether those skilled in the art would interpret the claim language at issue, as well as the cited portions of the prosecution and reexamination history, to support Defendant's proffered interpretations. Plaintiff has submitted evidence, including nonconclusory [*10] expert testimony, demonstrating that these terms are susceptible to a different interpretation.

Accordingly, the Court cannot grant Defendant's motion for summary judgment, and the issue of claim construction must go to the jury. *See Johnston v. IVAC Corp.*, 885 F.2d 1574, 1579 (Fed. Cir. 1989).

PLAINTIFF'S MOTION FOR SUMMARY JUDGMENT RE: INVALIDITY

This motion seeks summary judgment on Defendant's affirmative defense and counterclaim that the '806 patent is invalid.

Legal standards

Once a patent has survived reexamination, there is a very strong presumption of validity. Upon first issue, a patent is entitled to a presumption of validity that can only be overturned by clear and convincing evidence. After being affirmed on reexamination, the burden is described as even greater: "most formidable," *Central*

Soya Co., Inc. v. Geo. A. Hormel & Co., 723 F.2d 1573, 1577 (Fed. Cir. 1983), or "more difficult to sustain," *American Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350, 1359-60 (Fed. Cir. 1984). The PTO examiners are entitled to a presumption of administrative correctness. *Id.* at 1359. [*11] The reexamination findings of the PTO are highly probative, and should be given "substantial deference" by the Court. *E.I. Du Pont de Nemours & Co. v. Cetus Corp.*, 19 U.S.P.Q.2d (BNA) 1174, 1179 (N.D.Cal. 1990). As a matter of law, a patent examiner is presumed to have conducted her own independent analysis of the prior art and drawn her own conclusions. *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 938 (Fed. Cir.), cert. denied, 498 U.S. 920, 111 S. Ct. 296, 112 L. Ed. 2d 250 (1990).

Accordingly, to meet its burden to defeat Plaintiff's summary judgment motion, Defendant must proffer evidence which, if true, would overcome these strong presumptions, i.e., something more than clear and convincing evidence. Moreover, Defendant may not rely merely on its experts' conclusory opinions, if they rest on unsupported assumptions or ignore crucial distinctions and facts in the record, or are actually contradicted by factual record. See *McGlinchy v. Shell Chemical Co.*, 845 F.2d 802, 806-07 (9th Cir. 1988).

Discussion

Defendant's assertion of invalidity rests on three grounds: anticipation under 35 U.S.C. § 102, lack of [*12] enablement under 35 U.S.C. § 112, and obviousness under 35 U.S.C. § 103.²

2 Plaintiff argues that Defendant has admitted at various times that the patent is valid. Plaintiff asserts that such "admissions" bar Defendant from raising any arguments as to invalidity which rely upon prior art references known to Defendant when these admissions were made. However, an admission of a party opponent is only admissible to prove the factual truth of the statement. See *Fed. R. Evid. 801(d)(2)* and related Notes of Advisory Comm. The validity of a patent is a legal conclusion. Thus, Defendant's admissions of validity, while relevant as factual evidence of willful infringement, are not particularly relevant to determining whether the patent is valid, and certainly cannot be employed to bar Defendant from asserting invalidity. See, e.g., *Russell v. J.P. Seeburg Corp.*, 123 F.2d 509, 512 (7th Cir. 1941)

; *Amsted Ind. Inc. v. National Castings Inc.*, 16 U.S.P.Q.2d 1737, 1748 (N.D.Ill. 1990).

[*13] 1. Anticipation

Anticipation requires that each element of the claimed invention be disclosed in a single prior art reference. See *Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir. 1992); *Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1576 (Fed. Cir. 1991); *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026, 104 S. Ct. 1284, 79 L. Ed. 2d 687 (1984). Defendant identifies only *Mangold*, a prior art reference which was considered by the PTO both in the initial prosecution and the reexamination.³ See Rhyne Opp. Decl. at P 34. As the PTO clearly determined, *Mangold* does not include the patent's PROM. '806 patent.

3 *Mangold* described a "master hearing aid," essentially a testing device, rather than a hearing aid for permanent use by one patient. As such, it did not require nonvolatile memory. The patentee's claims as originally drafted would have included both volatile and nonvolatile memories; this was changed to include nonvolatile memory only, and the patentee argued to the PTO that the '806 patent was different than *Mangold* because the patent's PROM is restricted to nonvolatile digital memory. The original patent issued with that limitation. See Risman Decl. re: Infringement Exh. B. at B-30-38, B-66.

[*14] Defendant's only relevant argument relies upon its expert's statement that he does "not believe that one of ordinary skill in 1979 or 1980 could have taken the '806 patent and constructed the sound processing portion of a hearing aid in miniature form and at low power without months of design work and experimentation." Rhyne Opp. Decl. P 43. This assertion does not indicate, however, that "months" would be an abnormal length of time in the industry. See Gafford Reply Decl. PP 4-5 ("months" represents the standard amount of time to convert a design to silicon). Rhyne does not indicate that the design work or experimentation necessitated would be difficult, undue or unreasonable, nor does he provide sufficient factual support for such an assertion. Thus, Rhyne's assertion is clearly insufficient to meet the legal requirements for showing lack of enablement, and summary judgment must be granted on

this issue.

3. Obviousness

Obviousness is a question of law based on fact. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1568 (Fed. Cir. 1987), cert. denied, 481 U.S. 1052, 107 S. Ct. 2187, 95 L. Ed. 2d 843 (1987). To defeat Plaintiff's motion for summary judgment of nonobviousness, [*15] Defendant must proffer evidence sufficient to show that, to a person of ordinary skill in the pertinent art, the invention would have been obvious when the invention was unknown and just before it was made. *Id.* at 1566. Thus, the Court must view the prior art without reading into it the patent's teachings. *Id.* Prior art references must be considered in their entirety, including portions that would see *Ritchey Moving Decl. re: Invalidity Exh. I*, 2d p. Accordingly, *Mangold* does not anticipate the '806 patent, and summary judgment must be granted on anticipation.

2. Lack of enablement

To defeat Plaintiff's motion for summary judgment of validity on grounds of invalidity for lack of enablement, Defendant must proffer evidence sufficient to show that one skilled in the pertinent art, using the knowledge available and the patent disclosure, could not make and use the invention without undue experimentation. 35 U.S.C. § 112; *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1385 (Fed. Cir. 1986), cert. denied, 480 U.S. 947, 107 S. Ct. 1606, 94 L. Ed. 2d 792 (1987); *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 941 (Fed. Cir. 1990). [*16] A patent is enabling despite the fact that some experimentation is necessary. *Id.* The test for undue experimentation is not merely quantitative; "a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed." *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988) (citations omitted).

Defendant's argument that one of ordinary skill could not design a digital memory using less power than the prior art is irrelevant to this inquiry. Unlike the prior art, the patented invention uses a PROM which holds information without continuous electrical input. Similarly, Defendant's reliance on the history of the development of ReSound's own hearing aid is unavailing,

since ReSound claims it was not following the teachings of the lead away from the patented invention. *Id.* at 1568. Where a party asserts obviousness based on a combination of prior art references, that party must show some teaching or suggestion in the references that supported their use in combination. *Ashland Oil, Inc. v. Delta Resins & Refractories*, 776 F.2d 281, 293 (Fed. Cir. 1985), [*17] cert. denied, 475 U.S. 1017, 106 S. Ct. 1201, 89 L. Ed. 2d 315 (1986); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143 (Fed. Cir. 1985).

Defendant relies upon the declaration of its expert, Rhyne, to raise triable factual issues regarding obviousness. Rhyne relies upon six prior art references to make his case. Four of these references are identified in the prosecution history as having been considered by the patent examiner. Where Rhyne discusses these four, his conclusory assertions are insufficient to rebut the deference this Court must give to the PTO's findings that they did not render the invention obvious. Nor are Rhyne's assertions sufficient to rebut the presumption of validity. See, e.g., *In re Buchner*, 929 F.2d 660, 661 (Fed. Cir. 1991); *Chemical Engineering v. Essef Ind.*, 795 F.2d 1565, 1571 (Fed. Cir. 1986).

Moreover, Rhyne's method of identifying certain separate elements in the various prior art references as being present in the '806 patent, adding them all together, and drawing the conclusion that this analysis establishes obviousness is improper as a matter of law. *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1552 (Fed. Cir. 1983). [*18] With the possible exception of the *Dowle* reference, discussed below, Defendant has utterly failed to meet its burden of showing any teaching or suggestion in the prior art which supports using these elements in combination. Rhyne makes conclusory assertions only; he points to no teachings in the references themselves regarding their combination. Hindsight ability to reconstruct the invention from bits and pieces of prior art is insufficient as a matter of law. See *Interconnect Planning Corp.*, 774 F.2d at 1143. Thus, the portions of Rhyne's declaration in which he presents this piecemeal-addition analysis are irrelevant.

Accordingly, the Court need focus only on the two references which may not have been considered by the patent office, *Dowle* and *Barford*. Plaintiff correctly points out that Defendant has failed to meet its threshold burden of showing that *Dowle* and *Barford* actually were not considered by the PTO. See *Richdel, Inc. v. Sunspool*

Corp., 714 F.2d 1573, 1579 (Fed. Cir. 1983). Even assuming they were not considered by the PTO, Defendant has not shown that these references are more pertinent than those considered by the [*19] PTO. See *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1549 (Fed. Cir. 1983) ("It is upon introduction of art more pertinent or more relevant than that considered by the PTO . . . that the patent challenger's burden [to overcome the presumption of validity] may be more easily carried") (emphasis in original).

Both *Dowle* and *Barford* are papers concerning testing of multi-channel sound processing for hearing-impaired individuals. *Barford* describes a testing apparatus run by a computer. Rhyne states that "*Barford* is more pertinent than the prior art of record . . . because it specifically describes using a DEC PDP 8 computer as the source of digital code and describes DACs for converting the code to analog signals." ⁴ Rhyne Decl. P 12. However, Rhyne fails to give a factual explanation as to how this teaches the patented invention, nor how it is more pertinent than the prior art cited to the PTO.

4 According to Rhyne, a DAC, or "digital-to-analog converter," is a standard component, the use of which is a necessarily implied element of any design using digital memory to control analog sound processing components. Rhyne opines that the *Mangold* reference contemplated use of off-the-shelf, commercially available DACs. Rhyne Decl. P 7.

[*20] *Dowle* describes a digital computer simulation and hearing tests to aid in the design of future hearing aids which would use multiple channels. *Dowle* describes the prospective hearing aid which could potentially be designed with the aid of *Dowle's* computer simulated testing as follows:

The physical implementation of such an aid could be as either an analogue or a digital IC. Thin film hybrid circuits are also possible. The parameters need to be field programmable so as to match each patient's impairment. The obvious way to do this is to store the parameters in a ROM, so that at least part of the circuitry should be digital. The circuitry being developed will be described in a later paper.

Rhyne Decl. Exh. 5 at 291. At face value, this paragraph could be interpreted as suggesting the combination of the *Mangold* and *Moser* references. *Moser* was a purely digital sound processor, which stored digital coding in an erasable read only memory chip, or EPROM. In its petition for reexamination of the '806 patent, ReSound asserted that *Moser*, which had not previously been considered by the PTO, rendered the patent obvious. On reexamination, the examiner [*21] initially rejected the patent on grounds that it was obvious "to substitute a PROM device as taught by Moser et al for the C-MOS type memory device of Mangold et al in order to provide digital control signals to the [analog] compressor means and amplifier means" shown in *Mangold*. Risman Suppl. Decl. re: Infringement Exh. F. at F-200-01. ⁵ The patentee's response persuaded the examiner that this combination was not obvious, however, and the PTO necessarily found that *Mangold* and *Moser* did not render the invention obvious when it finally affirmed the patent on reexamination. See *id.* at F-225.

5 The examiner explained that the EPROM described in *Moser* rendered obvious the PROM described in the '806 patent: "The Moser at al reference teaches the use of an erasable programmable read only memory (EPROM) in a hearing aid for the purpose of storing digital control signals. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a standard PROM device since the PROM was a first generation storage device developed prior to the more complex EPROM." *Id.* at F-200.

[*22] Plaintiff argues that *Moser* is more pertinent than *Dowle*, since it teaches the same concepts but with more specificity than *Dowle*; thus, the PTO would not have reached a different conclusion based on *Dowle*. *Dowle* did not disclose an actual hearing aid design. Defendant's expert has conceded that *Dowle* would not enable anyone to build a hearing aid, and, in context, *Dowle's* reference to a prospective hearing aid was likely contemplating an all-digital system, such as that in *Moser*. Ritchey Reply Decl. re: Invalidity Exh. 17 (Rhyne Dep. at 75-76, 116-17).

Moser was not a wearable hearing aid, either. The patentee distinguished the '806 patent on grounds, *inter alia*, that using analog processing was a nonobvious

improvement on *Moser* which allowed the concept to be used in a wearable hearing aid. See Risman Suppl. Decl. re: Infringement Exh. F. at F-218-19. Thus, *Dowle's* reference to using such a combination in a wearable hearing aid could be seen as significant.

The analysis cannot stop here, however. Defendant must overcome its burden on this motion by showing more than one speculative statement that, considered in isolation, might indicate [*23] obviousness. Rather, Defendant must proffer enough evidence to overcome the strong presumption of validity, i.e., proof by more than clear and convincing evidence that the patented invention was obvious to those skilled in the art at the time the patent was issued. *Panduit*, 810 F.2d at 1566. As Plaintiff points out, the undisputed factual record strongly indicates that the invention disclosed in the '806 patent was not at all obvious to those skilled in the art. Indeed, it was not obvious to those actively attempting to develop a multi-channel hearing aid. In 1983, the same year the '806 patent was issued, researchers at AT&T began the research process which ReSound eventually inherited and which later culminated in ReSound's hearing aids. These researchers were undisputedly aware of, *inter alia*, *Dowle* and *Mangold*, but were unable to develop the combination described in the '806 patent. Instead, these researchers persisted for several years in their attempt to create an all-digital hearing aid. See Ritchey Moving Decl. re: Invalidity Exh. P.; Ritchey Reply Decl. re: Invalidity Exhs. 21, 22.

Accordingly, Defendant has not raised evidence sufficient to rebut [*24] the undisputed factual record indicating that, despite *Dowle*, the invention described in the '806 patent was not obvious to those skilled in the art who were actively trying to invent it. Summary judgment must therefore be granted on this issue.

DEFENDANT'S MOTION FOR SUMMARY JUDGMENT ON INEQUITABLE CONDUCT, ESTOPPEL AND LACHES, AND FAILURE TO JOIN INDISPENSABLE PARTIES

Defendant has conceded that it has no evidence of laches or failure to join indispensable parties. See Def.'s Opp. n.6. Despite Defendant's "decision to withdraw" laches and failure to join, summary judgment is appropriate on these affirmative defenses.

Similarly, summary judgment is appropriate on Defendant's affirmative defense of estoppel. Defendant's

only mention of this defense is found in a footnote in its Opposition brief: "Estoppel arises by operation of law based on statements made to the PTO during prosecution, as set forth in ReSound's Motion for Summary Judgment in Infringement Issues . . ." Def.'s Opp. n.6. However, Defendant's arguments in support of its own motion regarding infringement, which involved interpretation of prosecution history and claim construction, relate to file wrapper [*25] estoppel. They do not establish the necessary elements of an affirmative defense of equitable estoppel, which is a different legal concept. See *A.C. Aukerman Co. v. R.L. Chaides Constr. Co.*, 960 F.2d 1020, 1042-43 (Fed. Cir. 1992) (three elements of estoppel are (1) the patentee, through misleading statements or conduct, leads the alleged infringer to reasonably infer that the patentee does not intend to enforce its patent against the infringer, (2) the alleged infringer relies on the patentee's misleading statements or conduct, and (3) due to its reliance, the alleged infringer will be materially prejudiced if the patentee is allowed to proceed with its claim).

Supporting its affirmative defense and counterclaim for inequitable conduct in its opposition papers to the present motion, Defendant has raised the argument for the first time that the patentee failed to disclose specifically to the PTO a testing device, the Map II, which he purchased and used in the process of inventing his hearing aid.

To prove inequitable conduct, Defendant must show by clear and convincing evidence both intent to deceive the PTO and materiality. *Braun, Inc. v. Dynamics Corp. of America*, 975 F.2d 815, 822 (Fed. Cir. 1992); [*26] *Halliburton Co. v. Schlumberger Technology Corp.*, 925 F.2d 1435, 1440 (Fed. Cir. 1991). Determination of inequitable conduct ultimately rests in the discretion of the Court. The Court must first determine whether there are at least threshold levels both of the materiality of the misrepresentation or omission and intent to deceive. The Court must then balance the materiality with the level of culpable intent to determine whether it would be inequitable to enforce the patent. *Id.* at 1439-40. Defendant has failed to raise evidence sufficient to meet the threshold levels of either materiality or intent.

"Information is material if there is a 'substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent.'" *Halliburton*, 925 F.2d at 1440

(quoting 37 C.F.R. § 1.56(a)). If a reference is cumulative or less material than those already before the examiner, materiality for the purposes of inequitable conduct is not established. *Id.* To support its argument that the Map II was more pertinent than references considered by the examiner, [*27] Defendant asserts that the only structure described by claim 1 of the original '806 patent application reads on the Map II. Defendant's own expert admits that it does not. Cullum Reply Decl. re: Inequitable Conduct Exh. 3 (Rhyne Dep. at 125-26). The Map II is not a hearing aid. It has no digital memory, no speaker and no microphone. Defendant's expert, Rhyne, has conceded that the Map II has significantly different functionality than the invention claimed in the original '806 patent application. *Id.* at 124-30. Moreover, Rhyne admits that the patentee's general description as prior art of "frequency-domain, band-limited controllable equalizers and compressors" includes devices like the Map II. *Id.* at 128; Anderson Reply Decl. re: Inequitable Conduct Exh. 2 (Application at 2). Defendant has made no factual showing that the Map II is more pertinent than any of the other equipment generally described in this disclosure. Nor has Defendant made any factual showing that the Map II is more pertinent than *Mangold*, *Moser* or even *Dowle*. Indeed, at his deposition, Rhyne admitted that he knew of no art more pertinent to the '806 patent than *Moser*, *Mangold* and *Dowle*, although [*28] he was aware of the Map II at that time. Cullum Reply Decl. Exh. 3 at 119, 126.

In support of its argument that the intent element has been met, Defendant argues only that the patentee's failure to disclose the Map II supports an inference of intent to deceive. Because Defendant has failed to raise genuine issues of fact to demonstrate the materiality of the Map II, this argument must fail. *See FMC Corp. v. Manitowoc Co., Inc.*, 835 F.2d 1411, 1415 (Fed. Cir. 1987).

Defendant also raises two alternative theories of inequitable conduct: that the patentee misrepresented to the PTO that he had actually made his hearing aid, and that he misled the PTO regarding the size and power of his invention relative to that of *Mangold*. The first alleged misrepresentation is based upon a mischaracterization of what was said to the PTO. As Plaintiff demonstrates, the patent application does not imply that the patentee had actually built the invented device. *See* Anderson Reply Decl. Exh. 2 (Application at 11). Moreover, this asserted

"misrepresentation" is not material, since there is no requirement that an invention has been built to be patentable. *See* 35 U.S.C. § 112 [*29] ; *Hybritech, supra*, 802 F.2d at 1385.

Similarly, Defendant's argument that the patentee misled the PTO about the size and power requirements of the *Mangold* device mischaracterizes the nature and relevance of the arguments made to the PTO. The reexamination record is clear that the PTO was persuaded by the patentee's argument that, *overall*, his invention was smaller and required less power than *Mangold*. For *Mangold* to operate as a hearing aid (rather than a testing device), it would need a back-up battery to provide the continuous power necessary to retain the prescription, which would make *Mangold's* device too large to be practical. Thus, the patent's use of a PROM to replace *Mangold's* CMOS memory and a back-up battery enabled a significantly smaller device. Because the PROM does not require continuous power, its use represented an overall reduction in power consumption. Accordingly, Defendant's focus on the relative size and power requirements of *Mangold's* memory elements alone versus those of the '806 invention is unpersuasive and irrelevant.

CONCLUSION

For the foregoing reasons,

1. Defendant's motion for summary judgment [*30] of non-infringement is DENIED;

2. Plaintiff's motion for summary adjudication of Defendant's affirmative defenses and counterclaims of invalidity is GRANTED;

3. Plaintiff's motion for summary adjudication of Defendant's affirmative defense and counterclaim of inequitable conduct, and affirmative defenses of estoppel, laches and failure to join is GRANTED.

IT IS SO ORDERED.

Dated: March 10, 1995

CLAUDIA WILKEN

UNITED STATES DISTRICT JUDGE

EXHIBIT 18

EXHIBIT NO. 18
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 19

EXHIBIT NO. 19
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 20

EXHIBIT NO. 20
HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 21

A389/04

McGrigor Donald

Cti Molecular Imaging, Inc-V-Photonic Materials Limited & An
Maclay Murray & Spens**26 April 2006****Lord Mc Ewan**

The Lord Ordinary, on the unopposed motion of the Pursuer, Interpones authority of the Court to Joint Minute, No. 17 of process, and in terms thereof (1) Grants interdict against the first defender, its servants, agents or anyone acting on its behalf or under its instruction: (a) from infringing Claims 1 and 2 of the Patent in any manner whatsoever; (b) in particular and without prejudice to the generality of the foregoing, from making, disposing of, offering to dispose of, using or keeping for disposal or otherwise (i) a cerium-doped lutetium yttrium oxyorthosilicate scintillator crystal; or (ii) any other scintillator for use in a gamma ray or x-ray detector comprising: (a) a transparent single crystal of cerium-activated lutetium oxyorthosilicate having the general formulation $\text{Ce}_2\text{xLu}_2(1-\text{x})\text{SiO}_5$ where x is within the range of from approximately 2×10^{-4} to approximately 3×10^{-2} ; and/or (b) a transparent single crystal of cerium-activated lutetium oxyorthosilicate having the general formulation $\text{Ce}_2\text{xLu}_2(1-\text{x})\text{SiO}_5$ wherein x is within the range of approximately 1×10^{-3} to approximately 4.5×10^{-3} ; and (iii) from causing, authorising, inducing, facilitating, assisting, procuring or enabling any person to infringe Claims 1 and 2 of the Patent in any manner whatsoever. (2) Grants interdict against the first defender, its servants, agents or anyone acting on its behalf or under its instruction (a) from infringing Claim 3 of the Patent in any manner whatsoever; (b) in particular and without prejudice to the generality of the foregoing, from supplying or offering to supply in the United Kingdom any person other than the pursuer or second defender or other persons entitled to work the invention claimed in Claim 3 of the Patent with the means relating to any essential element of that invention for putting that invention into effect, in particular from supplying or offering to supply such persons with crystals falling within the scope of Claims 1 or 2 of the Patent including cerium-doped lutetium yttrium oxyorthosilicate scintillator crystals; and (c) from causing, authorising, inducing, facilitating, assisting, procuring or enabling any person to infringe Claim 3 of the Patent in any manner whatsoever. (3) Grants decree of dismissal in favour of the second defender. (4) Subject to decree being pronounced in terms of paragraphs 1, 2 and 3 above and without prejudice to any existing awards of expenses, finds no expenses due to or by any party; and decerns.

EXHIBIT 22

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

SIEMENS MEDICAL SOLUTIONS :

USA, INC. :

Plaintiff :

vs. : C.A. No.

SAINT-GOBAIN CERAMICS & : 07-190 (SLR)

PLASTICS, INC. :

Defendant :

Wednesday, October 10, 2007, 10:03 a.m.

Washington, D.C.

DEPOSITION OF MARVIN J. WEBER, PH.D.

Called for examination by counsel for the
Defendant, pursuant to notice, taken at the
offices of Kirkland & Ellis LLP, 655 Fifteenth
Street, N.W., Washington, D.C. 20005, before
Judith D. Van Vliet, Certified Shorthand Reporter
and Notary Public, commencing at 10:03 a.m., when
were present on behalf of the respective parties:

<p style="text-align: right;">106</p> <p>1 Q. Did you happen to review this paper?</p> <p>2 A. No.</p> <p>3 Q. Have you had any discussions with Dr.</p> <p>4 Melcher about this paper?</p> <p>5 A. No.</p> <p>6 Q. Is it correct to say, and I'm drawing</p> <p>7 from some of your previous answers, that you've</p> <p>8 read papers by this group but you're not sure</p> <p>9 whether you've read this paper?</p> <p>10 A. That's correct.</p> <p>11 Q. Do you recall reading in any of these</p> <p>12 papers that the group obtained LYSO crystal</p> <p>13 samples from a company called Crystal Photonics,</p> <p>14 CPI?</p> <p>15 A. Yes. The papers I've read, they</p> <p>16 talked about comparing LSO received from CTI.</p> <p>17 Q. I said CPI.</p> <p>18 A. CTI, the LSO crystals. The LYSO in</p> <p>19 the paper I read from Crystal Photonics contained</p> <p>20 five percent yttrium. And samples from</p> <p>21 San-Gobain contained 10 percent yttrium. And in</p> <p>22 these papers they compared the light emission</p> <p>23 properties of these samples.</p> <p>24 Q. So you are aware from reading these</p> <p>25 papers that LYSO crystals are available from both</p>	<p style="text-align: right;">108</p> <p>1 scintillation, so I -- and since I'm only there</p> <p>2 part-time I can't say unequivocally that we don't</p> <p>3 have any such samples.</p> <p>4 Q. Well, my question was going to be --</p> <p>5 I'm going to finish the whole question -- when</p> <p>6 you say they may have, I take it you don't know</p> <p>7 one way or the other. You're just saying that</p> <p>8 they have the potential of purchasing these</p> <p>9 crystals if they wish to, but you don't know that</p> <p>10 they did and you don't know that they didn't?</p> <p>11 A. Correct.</p> <p>12 Q. But it is correct to say that you</p> <p>13 personally, Dr. Weber, have not purchased any</p> <p>14 LYSO crystals?</p> <p>15 A. No. That's correct. No, I have not</p> <p>16 purchased them, that is correct.</p> <p>17 Q. Were you aware that Kenneth McClellan</p> <p>18 had received a patent related to an LYSO crystal?</p> <p>19 A. I've seen that patent.</p> <p>20 Q. Were you aware that Dr. Chai had</p> <p>21 received a patent on an LYSO crystal?</p> <p>22 A. Yes.</p> <p>23 Q. Have you read those two patents?</p> <p>24 A. I've reviewed them. I'm not sure I've</p> <p>25 read every single word of every one.</p>
<p style="text-align: right;">107</p> <p>1 CPI --</p> <p>2 A. Crystal Photonics.</p> <p>3 Q. Crystal Photonics. And San-Gobain?</p> <p>4 A. Yes.</p> <p>5 Q. Are you aware of any other sources of</p> <p>6 LYSO crystals?</p> <p>7 A. Photonics Materials in Scotland was</p> <p>8 making this material several years ago and</p> <p>9 supplied it to a number of people. I don't know</p> <p>10 whether these earlier papers, one of them in</p> <p>11 2005, may have had some of their material from</p> <p>12 Photonics Materials.</p> <p>13 Q. Are you aware of any other source of</p> <p>14 LYSO crystals other than the three you've</p> <p>15 identified?</p> <p>16 A. No.</p> <p>17 Q. Forgive me if I've asked this question</p> <p>18 before, but in your work at Lawrence Berkeley</p> <p>19 have you acquired any LYSO crystals?</p> <p>20 A. Personally, no. Other members of the</p> <p>21 group may have. And if -- and I don't know where</p> <p>22 they would have gotten them from.</p> <p>23 Q. When you say they may have --</p> <p>24 A. We have an inventory of hundreds and</p> <p>25 hundreds of different crystals which showed</p>	<p style="text-align: right;">109</p> <p>1 Q. When you use the term you reviewed</p> <p>2 them, what does that mean to you?</p> <p>3 A. I quickly read them.</p> <p>4 Q. You haven't studied them in detail?</p> <p>5 A. That would be a fair statement.</p> <p>6 Q. Did you reach any opinions with</p> <p>7 respect to the statements that were made by</p> <p>8 either McClellan or Chai in their respective --</p> <p>9 the specifications of their respective patents?</p> <p>10 A. Would you phrase that again or repeat</p> <p>11 that?</p> <p>12 Q. Sure. When you say you reviewed the</p> <p>13 patents -- and let's mark Chai first as 15.</p> <p>14 (Exhibit No. 15 is marked for</p> <p>15 identification.)</p> <p>16 MR. WHITMER: And McClellan we're</p> <p>17 going to mark as 16.</p> <p>18 (Exhibit No. 16 is marked for</p> <p>19 identification.)</p> <p>20 Q. You now have Exhibits 15 and 16 before</p> <p>21 you, sir. Exhibit 15 being the Chai patent,</p> <p>22 United States patent 6,624,420. Do you have</p> <p>23 that?</p> <p>24 A. Yes.</p> <p>25 Q. And the patent that had been issued to</p>

EXHIBIT 23



US006323489B1

(12) **United States Patent**
McClellan

(10) Patent No.: **US 6,323,489 B1**
(45) Date of Patent: **Nov. 27, 2001**

(54) **SINGLE CRYSTAL SCINTILLATOR**

(75) Inventor: **Kenneth J. McClellan, Los Alamos, NM (US)**

(73) Assignee: **Regents of the University of California, Los Alamos, NM (US)**

(*) Notice: **Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.**

(21) Appl. No.: **09/326,056**

(22) Filed: **Jun. 4, 1999**

(51) Int. Cl.⁷ **G01T 1/20**

(52) U.S. Cl. **250/361 R; 252/301.4 R**

(58) Field of Search **250/361 R, 483.1; 252/301.4 R; 117/13**

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Primary Examiner—Seungsook Ham

Assistant Examiner—Shun Lee

(74) Attorney, Agent, or Firm—Samuel L. Borkowsky

(57) **ABSTRACT**

The present invention relates to single crystal scintillators and includes a transparent single crystal of cerium-activated lutetium yttrium oxyorthosilicate having the general formula Lu_(1-x-y)Y_xCe_zSiO₆, wherein 0.05 ≤ x ≤ 1.95 and 0.001 ≤ z ≤ 0.02. The crystal scintillator of the present invention is dense, bright, rugged, and non-hygroscopic and has a relatively short decay time for luminescence. The invention also includes a scintillation detector using the crystal scintillator, which produces an electrical signal in response to light received from the crystal scintillator upon exposure to gamma rays, x-rays, and the like.

10 Claims, No Drawings

US 6,323,489 B1

1

SINGLE CRYSTAL SCINTILLATOR FIELD OF THE INVENTION

The present invention relates generally to single crystal scintillators for detecting radiation and more particularly, to single crystal scintillators having the formula $Lu_{1-x}Y_xCe_zSiO_3$, where $0.05 \leq x \leq 0.95$ and $0.001 \leq z \leq 0.02$. This invention was made with government support under Contract No. W-7405-ENG-36 awarded by the U.S. Department of Energy to The Regents of the University of California. The government has certain rights in the invention.

BACKGROUND OF THE INVENTION

Transparent single crystal scintillators are used to detect gamma rays, x-rays, cosmic rays, and other types of radiation, and to detect particles having energies of about 1 KeV and above. When radiation is incident on the scintillator, light pulses are generated by the scintillator that may be optically coupled to the photomultiplier tube of a scintillation detector to produce a voltage signal that is related to the number and amplitude of the light pulses received by the photomultiplier tube. Crystal scintillators are used in digital radiography, medical imaging, mineral and petroleum exploration, and other important applications.

A widely used scintillation detector employs the thallium-doped sodium iodide scintillator, NaI(Tl); it has a very high light output (i.e., is a very bright scintillator) in response to radiation and is relatively inexpensive to produce. Scintillation detectors employing NaI(Tl) are used in logging tools to aid in the location of petroleum deposits.

Inorganic metal oxides are another important group of materials used in scintillation detectors. These include bismuth germanium oxide $Bi_4Ge_3O_{12}$ (BGO) and cerium-activated oxyorthosilicates, which include cerium-activated gadolinium oxyorthosilicate $Gd_{1-x}Ce_xSiO_3$ (Ce:GSO), cerium-activated lutetium oxyorthosilicate $Lu_{1-x}Ce_xSiO_3$ (Ce:LSO), and cerium-activated yttrium oxyorthosilicate $Y_{1-x}Ce_xSiO_3$ (Ce:YSO). The data in The Table below, which is taken from the papers and patents that follow, summarizes relevant physical properties for NaI(Tl), Ce:BGO, Ce:GSO, Ce:LSO, and Ce:YSO. The decay time in nanoseconds refers to the time it takes for a particular scintillator crystal to luminesce from the excited electronic state, which is the time required before the crystal can respond to additional radiation once it has been exposed to sufficient radiation to produce an electronically excited state in the crystal. The reported range of decay times for several entries is likely a result of the difficulty in obtaining consistently uniform incorporation of cerium into the product crystal scintillator during crystal growth. The emission peak wavelength in nanometers refers to the wavelength maximum in the emission spectrum for the particular crystal scintillator.

TABLE 1

Property	NaI(Tl)	BGO	Ce:GSO	Ce:LSO	Ce:YSO
Density (g/cm ³)	3.67	7.13	6.71	7.4	4.45
Relative light output	100	72	25	75	118
Decay time (ns)	230	300	60	40	40-70
Emission peak wavelength (nm)	410	480	430	420	420
Rugged	No	Yes	No	Yes	Yes
Hygroscopic	Yes	No	No	No	No

U.S. Pat. No. 4,958,080 to C. L. Melcher entitled "Lutetium Orthosilicate Single Crystal Scintillator Detector," which issued on Sep. 18, 1990, describes Ce:LSO.

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U.S. Pat. No. 5,025,151 to C. L. Melcher entitled "Lutetium Orthosilicate Single Crystal Scintillator Detector", which issued on Jun. 18, 1991, describes an apparatus that uses the Ce:LSO scintillator of the '080 patent to investigate subsurface earth formations.

"Czochralski Growth of Rare Earth Oxyorthosilicate Single Crystals" by C. L. Melcher et al. was published in *J. Crys. Growth*, vol. 128, p. 1001-1005, (1993) and describes using the Czochralski crystal growing method to prepare single crystals of Ce:GSO, Ce:LSO, and Ce:YSO.

U.S. Pat. No. 5,660,627 to R. A. Manente et al. entitled "Method of Growing Lutetium Oxyorthosilicate Crystals," which issued on Aug. 26, 1997, describes an improved Czochralski crystal growth method for growing an LSO crystal that displays substantially uniform scintillation behavior throughout the crystal. Also described is a scintillation detector used with the crystal. "Physical Processes in Inorganic Scintillators" by P. A. Rodnyi, p. 50, CRC Press, New York, N.Y. (1997), includes data relating to Ce:YSO.

Ideally, a crystal scintillator is inexpensive to produce, has a fast decay time, and is dense, bright, and is a rugged crystal. As The Table clearly demonstrates, the decision to use a particular scintillator involves compromises between the various physical properties. Although NaI(Tl) is a very bright crystal scintillator, it is not dense so that much of the radiation incident on the crystal is not absorbed by the crystal. Due to its hygroscopic nature, NaI(Tl) must be protected from moisture and because it is not rugged, it should not be used in applications where it is subject to fracture. Finally, NaI(Tl) has the relatively long luminescence decay time of over 400 ns.

BGO is almost twice as dense as NaI(Tl) and is a rugged and non-hygroscopic crystal. However, BGO is not as bright a crystal as NaI(Tl) and has an even longer decay time. Ce:GSO is also a dense crystal scintillator and is a brighter crystal than BGO. However, Ce:GSO is not a rugged crystal.

Ce:YSO is a bright, rugged, non-hygroscopic crystal. Importantly, the starting yttrium oxide Y_2O_3 , which is used to grow Ce:YSO is relatively inexpensive, about \$20/kg for 99.99% pure Y_2O_3 . Ce:YSO has a melting temperature of about 2000° C., which is about 150 degrees lower than the melting temperature for Ce:LSO, making fabrication of Ce:YSO easier and less energy demanding than that for Ce:LSO. Unfortunately, Ce:YSO is not a very dense crystal, and decay times as long as 70 ns have been reported for this material.

Of the scintillators listed in The Table, Ce:LSO has the most desirable physical properties; it is a bright, dense, rugged, non-hygroscopic scintillator, and has a short decay time. However, Ce:LSO is extremely expensive, about \$2,000/kg for 99.99% pure material. In addition, the processing temperature for growing Ce:LSO is very high; Lu_2O_3 and LSO melt at temperatures of about 2310° C. and 2150° C., which adds to the difficulty of growing crystals of growing Ce:LSO.

Efforts to provide oxyorthosilicate scintillators with a broader range of properties have led to the production of cerium-activated single crystal scintillators having compositions that include a variety of lanthanide elements in combination with Gd, Lu, and Y. Examples of these are described in the papers and patents that follow. "Czochralski Growth of Rare-Earth Orthosilicates (Lu_2SiO_5)" by C. D. Brandle was published in *J. Crys. Growth*, vol 79, p. 308-315, (1986) and provides an evaluation of the Czochralski method for growing GSO, YSO, and a variety of orthosilicates containing either Gd or Y doped with a lan-

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thanide series element. The reported combinations with Y were YSO doped with Ce, Pr, Nd, Sm, Gd, Tb, Er, Tm, and Yb. The reported combinations with Gd were GSO doped with Ce and Tb. "Czochralski Growth and Characterization of $(Lu_{1-x}Gd_x)_2SiO_5$ " by G. B. Loulis et al. entitled was published in J. Cryst. Growth, vol. 174, p. 331-336, (1997), and describes single crystal oxyorthosilicate scintillators having both Lu and Gd.

US Pat. No. 4,647,781 to K. Takagi et al. entitled "Gamma Ray Detector," which issued on Mar. 3, 1987, describes a cerium-activated oxyorthosilicate scintillator having both Gd and Y and/or La. These scintillators have the general formula $Gd_{2(1-x-y)}Lu_xCe_ySiO_5$ where Ln is yttrium and/or lanthanum, where $0 \leq x \leq 0.5$, and $1 \times 10^{-2} \leq y \leq 0.1$.

U.S. Pat. No. 5,264,154 to S. Akiyama et al. entitled "Single Crystal Scintillator," which issued on Nov. 23, 1993, describes a single crystal scintillator and apparatus for prospecting underground strata using the scintillator. The single crystal scintillator is a cerium-doped oxyorthosilicate having the general formula $Gd_{2(1-x-y)}Lu_xCe_ySiO_5$ wherein Ln is Sc, Tb, Lu, Dy, Ho, Er, Tm, or Yb, $0.03 \leq x \leq 1.9$, and $0.001 \leq y \leq 0.2$.

Clearly, it is desirable to provide an affordable crystal scintillator having the most desirable properties for a particular application.

Therefore, an object of this invention is to provide an oxyorthosilicate crystal scintillator that can be used to detect gamma rays, x-rays, and the like.

Another object of the invention is to provide a crystal scintillator having excellent physical properties at a reasonable cost. Additional objects, advantages and novel features of the invention will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art upon examination of the following or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

SUMMARY OF THE INVENTION

To achieve the foregoing and other objects, and in accordance with the purposes of the present invention as embodied and broadly described herein, the invention includes a transparent single crystal scintillator of cerium-activated lutetium yttrium oxyorthosilicate having the general formula $Lu_{2(1-x-z)}Y_zCe_xSiO_5$, wherein $0.05 \leq x \leq 1.95$ and $0.001 \leq z \leq 0.02$.

DETAILED DESCRIPTION OF THE INVENTION

The present invention includes a single crystal scintillator containing lutetium and yttrium and having the general formula $Lu_{2(1-x-z)}Y_zCe_xSiO_5$ where $0.05 \leq x \leq 1.95$ and $0.001 \leq z \leq 0.02$. The invention also includes a scintillation detector for detecting gamma rays, x-rays, and the like using the crystal scintillator. The crystal scintillators of the present invention were grown using two conventional crystal growing processes: (1) the "Optical Float zone" method, and (2) the "Czochralski" method. The starting oxide materials used were Lu_2O_3 , CeO_2 , Y_2O_3 , and SiO_2 , and each had a purity of 99.99%.

A crystal of the present invention was grown by the optical float zone method by first blending Lu_2O_3 (71.4487 g), CeO_2 (0.1721 g), Y_2O_3 (4.5049 g), and SiO_2 (12.0169 g) in a mixer/mill for 30 minutes to give the composition

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$Lu_{1.7953}Y_{0.0995}Ce_{0.0050}SiO_{5.0025}$. The blended powder was loaded into a latex cold isostatic pressing (CIP) tube and pressed to about 7000 N/cm² for about 5 minutes. The resulting pressed rods were fired at about 1300° C. for about 8 hours to impart additional mechanical stability. After cooling, the rods were mounted in a dual halogen optical float-zone crystal growth furnace using platinum wire for fixturing. A single crystal was grown at a rate of about 2.0-2.5 mm/hr under flowing air using a seed crystal of Ce:LSO and standard float zone procedures. A stable molten zone was established between the seed crystal and the feed rod, which were counter-rotated at 45-60 rpm and passed through the hot zone.

The measured light output of the above single crystal of the present invention indicated that the crystal was as bright as Ce:LSO crystals made by the same crystal growing process. The measured crystal density of 7.1 g/cm³, which is identical to the density calculated by rule of mixtures, was only slightly lower than the reported density of 7.4 g/cm³ for Ce:LSO. The measured peak emission wavelength for the single crystal of the present invention was 420 nm.

A larger crystal having the same powder blend composition as the first was grown using the Czochralski method, which is discussed in the 1986 paper to D. C. Brandle et al. as previously described. About 320 g of starting oxide powder was blended and charged into an iridium crucible. Under a nitrogen atmosphere and using an iridium seed rotated at about 30 rpm, a 15-mm diameter single crystal was grown at a crystal growth rate of 1.5 mm/hr. The crystal was dense, bright, non-hygroscopic and rugged. The measured luminescence decay for this crystal was about 35-45 ns. For comparison, a crystal of Ce:LSO were grown by the Czochralski method. Less power was required to grow the crystal of the present invention than to grow the Ce:LSO crystal.

The optical float zone method was also used to grow additional crystals of the present invention, which included crystals from the starting blended oxide powders $Lu_{1.1970}Y_{0.7780}Ce_{0.0050}SiO_{5.0025}$ and $Lu_{0.9975}Y_{0.9975}Ce_{0.0050}SiO_{5.0025}$.

The crystal scintillators of the present invention can be used in a scintillation detector. To provide the scintillation detector, the crystal scintillator is optically coupled to a photodetector, which produces an electrical signal in response to light produced from the crystal scintillator in response to gamma rays, x-rays, and the like radiation incident upon the crystal scintillator. A wide variety of photodetectors can be used, such as photomultiplier tubes, photodiodes, microchannel plates, charge-coupled devices such as video cameras, etc. The crystal can be coupled to the photodetector by any of a variety of well-known coupling mechanisms or devices such as optical fibers, lenses, mirrors, grease, etc.

The foregoing description of the invention has been presented for purposes of illustration and description and is not intended to be exhaustive or to limit the invention to the precise form disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto.

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What is claimed is:

1. A crystal scintillator comprising a transparent single crystal of cerium-activated lutetium yttrium oxyorthosilicate having the general formula $\text{Lu}_{1-x}\text{Y}_x\text{Ce}_z\text{SiO}_5$, wherein $0.05 \leq x \leq 1.95$ and $0.001 \leq z \leq 0.02$.

2. The crystal scintillator of claim 1, wherein $0.2 \leq x \leq 1.8$.

3. The crystal scintillator of claim 2, wherein said scintillator has a luminescence wavelength of about 420 nm.

4. The crystal scintillator of claim 3, wherein said scintillator has a luminescence decay time of about 35–45 ns. 10

5. A scintillation detector, comprising:

(a) a crystal scintillator comprising a transparent single crystal of cerium-activated lutetium yttrium oxyorthosilicate having the general formula $\text{Lu}_{1-x}\text{Y}_x\text{Ce}_z\text{SiO}_5$, wherein $0.05 \leq x \leq 1.95$ and $0.001 \leq z \leq 0.02$; and 15

(b) a photodetector optically coupled to said crystal scintillator for detecting light from said crystal scintillator.

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6. The detector of claim 5, wherein said photodetector comprises a photomultiplier tube.

7. The detector of claim 5, wherein said photodetector comprises a charge-coupled device.

8. A scintillation detector, comprising:

(a) a crystal scintillator comprising a transparent single crystal of cerium-activated lutetium yttrium oxyorthosilicate having the general formula $\text{Lu}_{1-x}\text{Y}_x\text{Ce}_z\text{SiO}_5$, wherein $0.2 \leq x \leq 1.8$ and $0.001 \leq z \leq 0.02$; and

(b) a photodetector optically coupled to said crystal scintillator for detecting light from said crystal scintillator.

9. The detector of claim 8, wherein said photodetector comprises a photomultiplier tube.

10. The detector of claim 8, wherein said photodetector comprises a charge-coupled device.

* * * * *

Adverse Decision In Interference

Patent No. 6,323,489, Kenneth J. McClellan, SINGLE CRYSTAL SCINETILLATOR, Interference No. 105,083, final judgment adverse to the patentee rendered April 28, 2003, as to claims 1-10.
(Official Gazette June 10, 2003)

EXHIBIT 24

Crystal growth and optical characterization of cerium-doped $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$

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(Received 9 June 2000; accepted for publication 4 October 2000)

Czochralski growth of cerium-doped $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$ (LYSO) from a 90/10 solution of Lu_2SiO_5 (LSO) and Y_2SiO_5 (YSO) is demonstrated. The alloyed scintillator retains the favorable growth properties of YSO and the desirable physical and optical scintillator properties of LSO. Radioluminescence, thermally stimulated luminescence, optical absorption, and lifetime measurements confirm the equivalence of LYSO and LSO optical properties. Advantages of LYSO Czochralski growth relative to LSO include reduced melting point, less propensity for formation of crystalline inclusions, lower cost of starting material, and easier incorporation of cerium into the host lattice. This material offers an attractive alternative to LSO for scintillator applications.
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A good scintillator is characterized by excellent light yield, fast decay time, relative high density, and absence of self-absorption in the visible portion of the electromagnetic spectrum. Rare-earth oxyorthosilicates (Ln_2SiO_5), with cerium substituting for a small fraction of the host lanthanide ions, are currently the phosphors of choice for most scintillator applications.¹ Optical properties of single-crystal $\text{Lu}_2\text{SiO}_5\text{:Ce}$ (LSO) and $\text{Gd}_2\text{SiO}_5\text{:Ce}$, with respective densities 7.4 and 6.7 g/cm³, have been reported along with those of $\text{Y}_2\text{SiO}_5\text{:Ce}$ (YSO).² The latter material has received less attention as a scintillator due to its relative low density (4.5 g/cm³) and corresponding lower stopping power for energetic particles and photons.

Single-crystal growth of oxyorthosilicates by the Czochralski technique has been well documented³ and their optical and physical properties have been evaluated and discussed in previous work.² Unfortunately, single-crystal-growth technology for LSO is substantially less mature than for YSO. This is partially due to the higher melting point of LSO ($\approx 2150^\circ\text{C}$) relative to YSO ($\approx 1980^\circ\text{C}$) and the concomitant technical problems, as well as the high cost of Lu_2O_3 relative to Y_2O_3 . An attractive alternative material would be an alloy that retains the favorable scintillator properties of LSO along with the growth characteristics and costs associated with YSO. Accordingly, we have investigated solid solutions of LSO and YSO in an effort to strike a balance between the performance and production limitations of these two systems.

In the present work, we demonstrate successful Czochralski growth of cerium-doped $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$ (LYSO) and show that it retains the desired optical and physical properties of LSO, as well as the growth parameters and costs of YSO. We discuss the advantages associated with growth of

this scintillator relative to its constituents and conclude that it offers an attractive alternative to LSO.

The desire to maintain a relatively high density for the alloyed scintillator dictated only consideration of Lu-rich mixtures, and, therefore, we limited our choice to a 90/10 solid solution of LSO/YSO, i.e., $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$, with approximately 0.05 at. % Ce substituting for the lutetium and yttrium ions. Single crystals of LSO, YSO, and LYSO were grown under similar conditions by the Czochralski technique. Samples were pulled from an iridium crucible under a nominal $\text{N}_2 + 3000 \text{ ppm O}_2$ atmosphere, with typical growth rate of 3 mm/h. Seeded growth occurred by employing an off-axis seed of typical cross section 5–7 mm², with the growth interface being convex to the melt surface. The initial Ce content in the melt for LYSO was 0.25 at. % (relative to the rare-earth sites), but with a measured Ce distribution coefficient 0.28, we estimated the Ce content to be $\approx 0.07\%$ with respect to rare-earth sites at the top of the boule. A similar Ce concentration exists in LSO, but is slightly higher in YSO due to the larger Ce distribution coefficient (0.34).⁴ An important implication of the larger coefficient is that the YSO host lattice more readily accepts incorporation of Ce than does the LSO lattice. Thus, alloying LSO with YSO can be expected to yield a more open lattice (relative to LSO) that can accommodate a higher Ce concentration. This provides experimental opportunity to investigate the important relationship between the Ce content and light output over a broader concentration range than allowed in LSO.

The melting point for LYSO is estimated to be 2100°C and the measured density is 7.11 g/cm³. Although modest, the $\sim 2\%$ reduction (relative to LSO) in melting point has significant, practical crystal growth implications. Experimentally, we found the decrease in melting point for LYSO to improve the single-crystal production rate over LSO through

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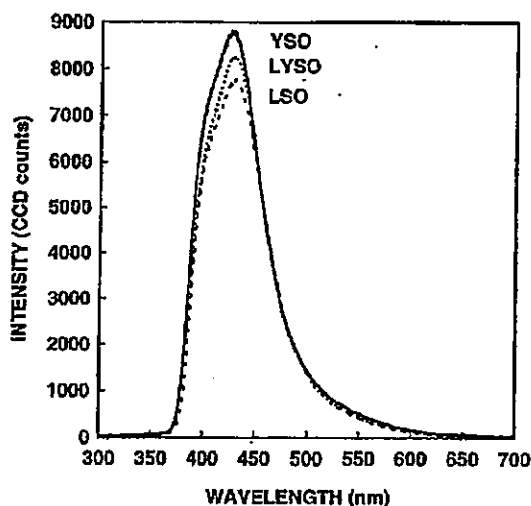


FIG. 1. Typical RL emission spectra of YSO (solid line), LYSO (dotted line), and LSO (dashed line).

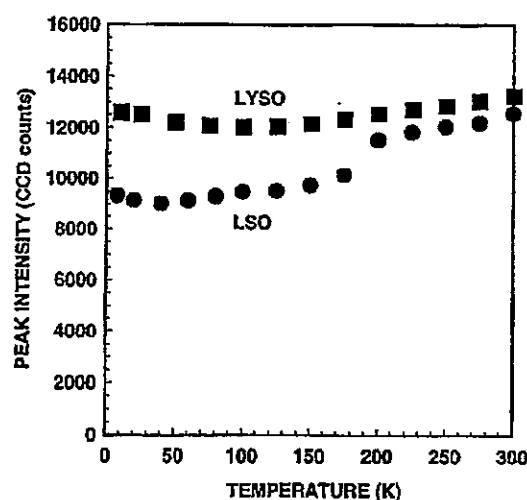


FIG. 2. Temperature dependence of LYSO and LSO radioluminescence peak intensities.

increased iridium crucible (melting point $\approx 2450^\circ\text{C}$) lifetime.

Another advantage of Czochralski-grown LYSO over LSO is the apparent reduction in concentration of optical scattering centers in LYSO, which we believe is due to subtle differences in their respective melt viscosities. Optical and scanning electron microscopy examinations of LSO show the scattering centers to mainly consist of rare-earth oxide inclusions.

To demonstrate no deterioration of favorable LYSO optical properties, we measured radioluminescence (RL), thermally stimulated luminescence (TSL), optical absorption, and emission lifetime of LYSO, LSO, and YSO, and compared the results. Typical experimental details describing all techniques except the lifetime measurements have been previously described.⁵ Lifetime measurements were made with a N_2 laser ($\lambda = 337.1\text{ nm}$; pulse width $= 20\text{ ns}$), whose output was directed onto samples of approximately 1 cm^3 volume. A vacuum photodiode located perpendicular to the incident laser beam recorded spectral emission from the scintillator. Following pulse excitation, temporal decay of the emission intensity was measured by a digital oscilloscope and subsequently transferred to a desktop computer for analysis. A long-pass filter was placed between the sample and detector to eliminate scattered laser radiation. Signal to noise was enhanced by signal averaging a total of 128 emission versus time scans.

Figure 1 shows a comparison of room-temperature RL from x-ray-excited LSO, YSO, and LYSO. These spectra represent the average of four measurements on each sample whereby a repeatability error of $\pm 5\%$ was established. In each sample, the emission is characteristic of the $5d \rightarrow 4f$ electronic transition of the Ce^{3+} ions, and, within experimental error, are equal in intensity.

Temperature dependencies of LYSO and LSO RL peak intensities are shown in Fig. 2. (Note that for these measure-

ments an experimental arrangement different from that used to obtain the data shown in Fig. 1 was employed; therefore, peak intensities at 300 K, shown in the two graphs, are not equal). The data shown in Fig. 2 were taken as the sample temperature increased from 10 to 300 K, although a few measurements were made by decreasing the temperature to confirm the absence of hysteresis. Sample temperature at each selected point was maintained within two degrees of the desired value by a temperature controller, and was held at that temperature for five minutes prior to measuring RL. Total irradiation time at each temperature was one minute (exposure rate $= 200\text{ R/s}$). Although similar, the temperature-dependent RL of both LSO and LYSO are unusual in that they exhibit higher quantum efficiencies at room temperature than at low temperature; similar results have been previously reported for LSO.⁶

Optical absorption for the three specimens is compared in Fig. 3. As expected, the LYSO absorption is nearly identical to YSO and LSO absorption, each one dominated by the strong transitions of the Ce^{3+} ions with the appearance of a band edge near 200 nm .⁴

Results of lifetime measurements are illustrated in Fig. 4. Data in the interval from 20 to 300 ns are well described by a single exponential decay, $I(t) = I_0 \exp(-t/\tau)$, where I_0 is initial spectral intensity and τ is lifetime. Lifetime data for $t < 20\text{ ns}$ were excluded because they overlapped the excitation laser-pulse width. The extracted values with goodness of fit are: LSO ($\tau = 37.4\text{ ns}$, $\chi^2 = 0.999$); YSO ($\tau = 39.2\text{ ns}$, $\chi^2 = 0.999$); and LYSO ($\tau = 41.5\text{ ns}$, $\chi^2 = 0.999$). Similar values have been previously reported for LSO and YSO.⁴ It is notable that the decay follows the single exponential rate out to $t > 7\tau$, indicating complete absence of deleterious afterglow. Lempicki *et al.*⁶ measured significant afterglow in gamma-excited LSO and suggested that it be correlated with the presence of an electron trap near 340 K. As shown in Fig.

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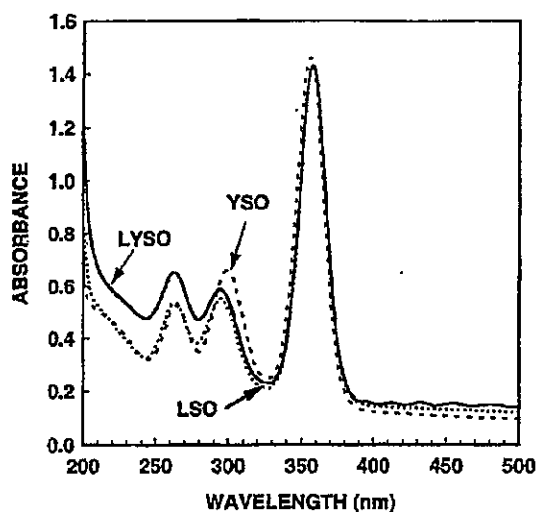
Cooke *et al.*

FIG. 3. Optical absorption spectra of LYSO (solid line), LSO (dotted line), and YSO (dashed line). Main absorption bands correspond to $5d \rightarrow 4f$ transitions of Ce^{3+} ions. Typical sample thickness is 0.65 mm.

5, LYSO and LSO exhibit this TSL glow peak but not the intense afterglow. The glow peak maximum occurs near 390 K rather than 340 K due to the faster heating rate used in the present experiment. Presumably, optical excitation employed in the present lifetime measurement does not populate the electron traps near 390 K as efficiently as does the gamma excitation utilized in the experiment of Lempicki *et al.* In the

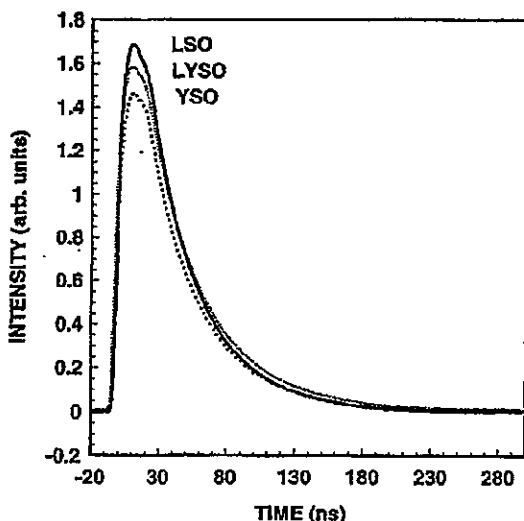


FIG. 4. Decay of 337 nm excited emission in LSO (solid line), LYSO (dotted line), and YSO (dashed line). The temporal behavior of each sample is nearly identical and is well described by a single exponential with lifetime ~ 40 ns.

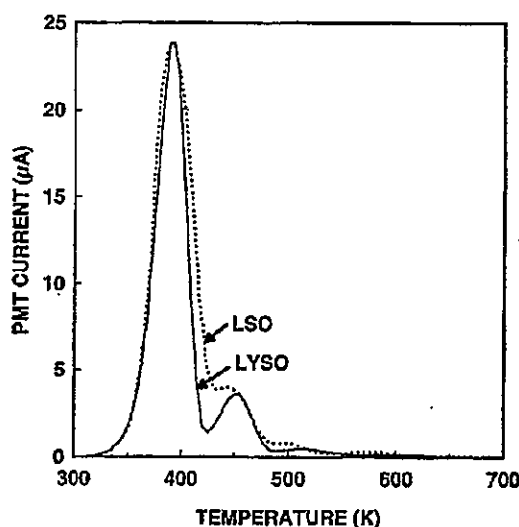


FIG. 5. TSL glow curve of LYSO (solid line) and LSO (dotted line) obtained with heating rate of 5 K/s. The main glow peak in each sample occurs near 390 K.

latter experiment, we expect significant afterglow due to the release of trapped electrons and their recombination at Ce ions. This spectral contribution is in addition to the electronic deexcitation that occurs within the Ce^{3+} manifold alone. The time interval for release of these trapped electrons and their subsequent recombination at the Ce ion sites is expected to exceed the ~ 40 ns typically associated with Ce^{3+} deexcitation in LSO. The net effect of the slow release of trapped electrons is to enhance the emission intensity at times exceeding several τ , and, thus, to produce afterglow.

In conclusion, we have demonstrated that alloying LSO with YSO yields a material, $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$, which provides benefits from the favorable growth properties and costs of YSO while retaining the desirable physical and optical scintillator parameters of LSO. Advantages of LYSO Czochralski growth over LSO include reduced melting point, less propensity for formation of inclusions, longer crucible lifetime, lower cost of starting material, and easier incorporation of cerium into the host lattice. This material offers an attractive alternative to LSO for scintillator applications.

This research was supported by the U.S. Department of Energy and administered by the University of California.

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EXHIBIT 25

High Efficiency of Lutetium Silicate Scintillators, Ce-Doped LPS, and LYSO Crystals

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Abstract—Cerium doped lutetium pyrosilicate $\text{Lu}_2\text{Si}_2\text{O}_7$ (Ce: LPS) scintillator presents high light output (average value: 26,300 ph/MeV), a relatively good energy resolution (10%) and a fast decay time (38 ns) without afterglow. The luminescence efficiency remains very high when the temperature increases up to 450 K. It makes this new scintillator very attractive. We compare its properties to those of another recently developed cerium doped silicate, Ce: $\text{Lu}_{2(1-x)}\text{Y}_{2x}\text{SiO}_5$ (LYSO).

Index Terms— γ distribution, $\text{Lu}_{2(1-x)}\text{Y}_{2x}\text{SiO}_5$ (LYSO), lutetium pyrosilicate (LPS), lutetium silicates, scintillation crystals.

I. INTRODUCTION

A number of cerium doped silicate based scintillators have been developed, GSO (Ce: Gd_2SiO_5) [1], LSO (Ce: Lu_2SiO_5) [2], and LYSO (Ce: $\text{Lu}_{2(1-x)}\text{Y}_{2x}\text{SiO}_5$) [3], [4]. These materials exhibit desirable qualities for gamma-rays detection: high density, scintillation decay times shorter than 100 ns and light output exceeding that of BGO ($\text{Bi}_4\text{Ge}_3\text{O}_{12}$), which is still commonly used for gamma-rays detection.

The cerium doped lutetium pyrosilicate (LPS), Ce^{3+} : $\text{Lu}_2\text{Si}_2\text{O}_7$, is a recently developed inorganic scintillator, which displays particularly promising performance for applications such as positron emission tomography (PET) or oil well logging [5], [6]. The main characteristics are shown in Table I, together with those of cerium-doped LSO and LYSO.

II. MATERIALS

LPS and LYSO crystals were grown from the melt by a vertical pulling method (Czochralski process) using an iridium crucible. For LYSO, the yttrium content is 10% atomic. The initial cerium concentration ranges from 0.1% to 0.5% depending on the crystals. Samples about 1 cm^3 were cut and polished for scintillation measurements (see Fig. 1).

Manuscript received November 3, 2003; revised March 12, 2004. This work was supported by Saint Gobain Crystals, by French-Dutch Van Gogh exchanges, and by the French Office of Industry (Convention no. 014906108).

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Digital Object Identifier 10.1109/TNS.2004.829542

TABLE I
PROPERTIES OF CERMIUM-DOPED LUTETIUM SILICATE BASED SCINTILLATORS

	LSO	LYSO*	LPS
Melting point (°C)	2100	2050	1900
Density (g cm ⁻³)	7.4	7.11	6.23
Z _{eff}	66	65	64
Refractive index	1.81	1.81	1.74
$\lambda_{\text{emission}}$ (nm)	420	420	385

*In the present work, $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$ (10% atomic of Y) is investigated

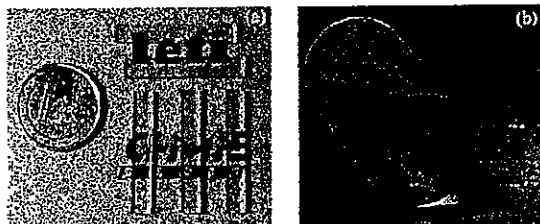


Fig. 1. (a) LPS cut samples ($30 \times 5 \times 2 \text{ mm}^3$); (b) LYSO crystals.

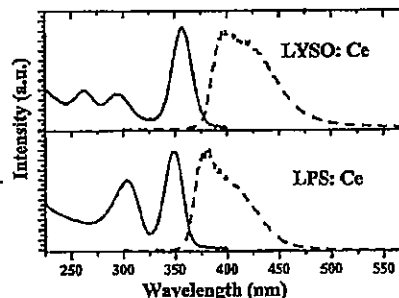


Fig. 2. Optical characteristics at room temperature of $\text{Lu}_2\text{Si}_2\text{O}_7$: Ce and $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$: Ce crystals: absorption spectra (solid lines) and emission spectra (dashed lines) under X-ray excitation.

III. OPTICAL PROPERTIES

A. Absorption and Emission Spectra

Optical absorption experiments were done using a CARY 5, Varian spectrophotometer. Decay time profiles under UV-excitation were obtained with the third harmonic of a Nd: YAG laser ($\lambda_{\text{exc}} = 355 \text{ nm}$) at temperatures ranging from 10 K to 600 K. X-ray-excited optical luminescence spectra were recorded using an X-ray tube with a Cu-anode operating at 35 kV and 25 mA. The data were corrected for the wavelength dependence of the PMT quantum efficiency and for the monochromator response.

In Fig. 2, the absorption (solid lines) and emission (dashed lines) spectra of LPS: Ce and LYSO: Ce, at room temperature,

TABLE II
OPTICAL PROPERTIES OF Ce-DOPED LPS AND LYSO CRYSTALS AT RT

	LPS	LYSO
Absorption	349 / 303nm	357 / 295 / 262nm
Emission	378 / 405nm	397 / 427nm
Stokes shift	2,200cm ⁻¹	2,800cm ⁻¹

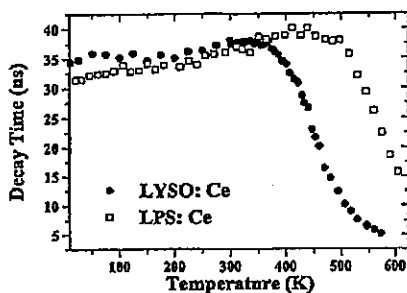


Fig. 3. Decay times ($\lambda_{exc} = 355$ nm) of Ce^{3+} in LPS ($\lambda_{em} = 385$ nm) and in LYSO ($\lambda_{em} = 393$ nm) as function of temperature.

are presented. The main optical properties deduced from these experiments are gathered in Table II.

Fig. 3 presents the temperature dependence of the decay time under UV-excitation for both materials. Home-made furnace with temperature accuracy about 2°C was used. Results are similar for increasing or decreasing temperature variation. The rollover points of the decay time are close to 450 K and 350 K for LPS and LYSO respectively. For both materials, two distinct trends are observed. First, below the rollover point, the decay time slightly increases with temperature. Second, beyond the rollover point, when the temperature increases, the experimental lifetime strongly decreases. Such temperature dependence of the measured fluorescence lifetimes has already been reported for cerium doped: $YAlO_3$, $Y_3Al_5O_{12}$, CaF_2 , and $YLiF_4$ compounds [7] and LSO:Ce [18]. The total decay rate is given by

$$\tau_{exp}^{-1} = \tau_R^{-1} + \tau_{NR}^{-1} \quad (1)$$

where τ_{exp} is the experimental fluorescence lifetime of the $5d-4f$ transition and τ_R and τ_{NR} are the contributions from radiative and nonradiative processes, respectively.

Below rollover points, radiative transitions dominate and slow linear increase of τ_R with increasing temperature is observed for both compounds. This increase is more important for LPS:Ce than for LYSO:Ce. Such thermal dependence of decay time is attributed to self-absorption phenomenon [8], [9]. Indeed, Ce^{3+} -emission can be delayed by self-absorption when overlap between cerium absorption and emission bands exists (Fig. 2). As this delay depends on the overlap, it is linked to the band width and consequently to the temperature. In LPS, the Ce^{3+} Stokes shift is smaller than in LYSO (Table II), so the self-absorption phenomenon should be stronger in LPS, leading to a more significant increase of decay time with temperature, as it is observed in Fig. 3.

Above rollover points, the rapid decrease of the decay time values means that nonradiative de-excitation dominates. The nonradiative decay rate $W_{NR}(= \tau_{NR}^{-1})$ is calculated from (1)

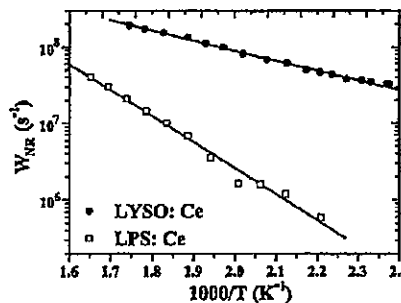


Fig. 4. Nonradiative decay rate for Ce^{3+} : LPS and Ce^{3+} : LYSO as a function of inverse temperature. Solid lines fit the data with (2). The corresponding activation energies ΔE are equal to 0.68 ± 0.03 and 0.27 ± 0.01 eV respectively and the attempt frequencies are $1.6 \cdot 10^{13} \pm 10^{13}$ and $5 \cdot 10^{10} \pm 0.5 \cdot 10^{10}$ Hz.

for temperatures higher than the rollover points. Fig. 4 illustrates the temperature dependence of the deduced nonradiative relaxation rate. The adjustment has been realized assuming that W_{NR} varies with temperature, following an Arrhenius law:

$$W_{NR} = W_0 \times \exp\left(-\frac{\Delta E}{k_B T}\right) \quad (2)$$

where k_B is the Boltzmann constant, W_0 the attempt frequency and ΔE the activation energy. The activation energies are equal to 0.68 and 0.27 eV for LPS and LYSO respectively and the attempt frequencies are $1.6 \cdot 10^{13}$ and $5 \cdot 10^{10}$ Hz. If we assume, as in [7], that quenching of Ce^{3+} luminescence is caused by autoionization of the $5d$ electron into the conduction band, then ΔE should be related to the energy difference between the bottom of the conduction band and the position of the lowest $5d$ level. Consequently in LYSO, the lowest $5d$ level is closer to the bottom of the conduction band than in LPS.

IV. SCINTILLATION PROPERTIES

A. Light Output and Energy Resolution

To determine the light yields, crystals $30 \times 5 \times 2$ mm³ and $10 \times 10 \times 10$ mm³ were mounted, using optical grease, to the window of a Hamamatsu R1791 photomultiplier tube. Results are comparable for both shapes. Crystals were covered with several layers of Teflon tape. The absolute photoelectron light yield was obtained by comparing the 662 keV photopeak position, in the pulse height spectrum of a ^{137}Cs source, with the maximum position in the pulse height spectrum of single photoelectron from the photocathode. The shaping time was 10 μ s. More details about this experiment are presented in [10]. Samples extracted from several boules present an average light yield of $26300 \pm 3,000$ ph/MeV for LPS and $33800 \pm 2,200$ ph/MeV for LYSO. The energy resolution ranges between 7.5% and 9.5% for LYSO, and between 9.5% and 12.5% for LPS. Examples of pulse height spectra are given in Fig. 5 where values of 26 600 ph/MeV are presented for the LPS and 34 100 ph/MeV for the LYSO. For LPS and LYSO crystals, the energy resolutions are 11.1% and 8.1% respectively. The intrinsic background activity from the crystal itself was also measured. This background, obtained without excitation, arises from the beta

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IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 51, NO. 3, JUNE 2004

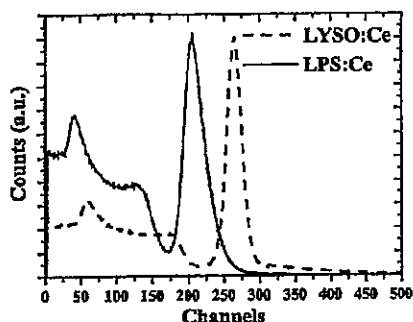


Fig. 5. Pulse height spectra of LPS and LYSO crystals (dimensions: 10 mm \times 10 mm \times 10 mm). Source: ^{137}Cs at 662 keV.

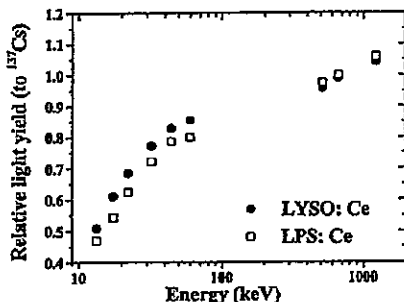


Fig. 6. Scintillation light yields for LPS:Ce and LYSO:Ce crystals, at room temperature, as a function of excitation energy, normalized to the light yield at 662 keV excitation.

decay of ^{176}Lu isotope, which represents 2.6% of natural Lu abundance. The intrinsic background activities of LPS:Ce and LYSO:Ce (10% Y) are equal to 219 and 263 $\text{counts.s}^{-1}.\text{cm}^{-3}$ respectively, which is somewhat less than for LSO:Ce or LuAP:Ce (318 and 323 $\text{counts.s}^{-1}.\text{cm}^{-3}$ respectively [11]).

B. Nonproportionality

The variation of the scintillation response as a function of the incident energy was investigated. For excitation energies varying between 60 keV and 1.22 MeV, ^{241}Am , ^{137}Cs and ^{22}Na γ -ray sources were used. An Amersham (code AMC.2084) variable X-ray source was used to excite the crystals at energies ranging between 13.5 and 44.5 keV. In this source, ^{241}Am produces characteristic K_{α} and K_{β} X-rays from Rb, Mo, Ag, Ba and Tb targets. The relative light yields were then obtained by comparing the absolute light yield for different energies, with the absolute light yield under ^{137}Cs -excitation (662 keV). The shaping time was 3 μs .

Fig. 6 shows nonproportional scintillation response curves of LPS:Ce and LYSO:Ce crystals. For each sample, the light output is approximately divided by two when incident energy decreases from 1 MeV to 14 keV. It appears so far, that all silicate materials, like LSO, YSO, GSO or LGSO [12]–[14], exhibit large nonproportionality in the light output. The nonproportionality in the scintillation response could be a common feature in all silicate based scintillators. Further works are required to understand such behavior.

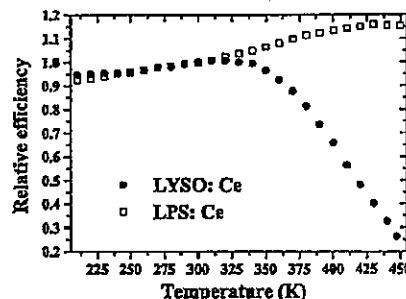


Fig. 7. Luminescence efficiency under gamma-ray (^{137}Cs) excitation of LPS:Ce $^{3+}$ and LYSO:Ce $^{3+}$ as function of temperature. For room temperature, the light yield (shaping time: 12 μs) was normalized. One can notice that the nonradiative decay rate for the LYSO:Ce under gamma-ray excitation leads to an activation energy about 0.24 eV, a similar value to those obtained from the lifetimes (see above).

The nonproportional response of the scintillator influences the ultimate energy resolution [13]–[17]. Then, for LPS:Ce and LYSO:Ce, the strong nonproportionality response could partially explain the limited energy resolution values. Moreover, the crystalline quality of the LPS:Ce laboratory samples could be further improved, as some defects are still present in the crystals. These inhomogeneities could, in some way, affect the energy resolution [13].

C. High-Temperature Luminescence Efficiency

Under gamma-ray excitation (^{137}Cs), we measured the emission intensity as function of temperature for Ce-doped LPS and LYSO (Fig. 7). A Hamamatsu R2256 PMT was employed as detector. The PMT is maintained at 35°C and a light pipe is used between the crystal and the PMT. For LYSO:Ce, the light efficiency decreases significantly above room temperature, as it was observed for LSO crystals [18]. On the contrary, for LPS:Ce, the luminescence efficiency remains very high when the temperature increases up to 450 K. This major difference in thermal behaviors could allow LPS:Ce scintillation detectors to be used under relatively high temperature conditions. For oil well logging, for instance, the temperature is about 90°C (385 K) at $\sim 2,000$ meters depth and reaches 170°C (445 K) at 5,000 m below the surface [19].

The different behaviors in term of high-temperature efficiency can be explained by previous results. As the activation energy between the lowest 5d level and the conduction band is smaller in LYSO than in LPS (0.28 and 0.68 eV respectively), a lower quenching temperature is expected in LYSO, which is indeed observed here. In addition, decay times and luminescence efficiency follow the same trend: above a rollover temperature, a rapid decrease of the decay time values dominates, due to nonradiative de-excitation and this is correlated to a strong quenching of the luminescence efficiency.

D. Decay Times Under Gamma-Ray Irradiation

Scintillation decay time spectra, under ^{137}Cs (662 keV) γ -ray excitation, were recorded with two Philips XP2020Q PMTs, using standard start-stop techniques as described in [20]. Fig. 8 shows the decay time spectra of LPS:Ce and LYSO:Ce. The solid

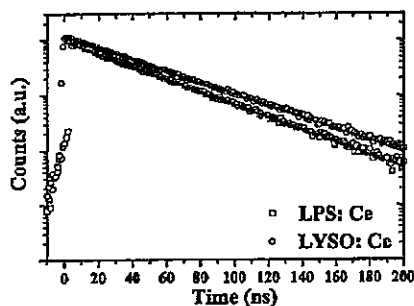


Fig. 8. Decay curves of LPS:Ce and LYSO:Ce crystals at room temperature under gamma-excitation, with a ^{137}Cs source. The solid curves fit the data with a single exponential.

TABLE III
SCINTILLATION PROPERTIES AND MAIN QUALITIES OF LPS:Ce AND LYSO:Ce

	Light Yield	Energy resolution	Decay time	Advantages
LPS $\text{Lu}_2\text{Si}_2\text{O}_7$	26,300 ph/MeV	9.5–12.5%	38 ns	High-temperature efficiency No afterglow
LYSO $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$	33,800 ph/MeV	7.5–9.5%	41 ns+ afterglow	High light yield Good optical quality High stopping power

curves fit the data with a single exponential. The deduced decay times are 38 ns and 41 ns, for LPS:Ce and LYSO:Ce respectively. Assuming that the oscillator strengths are comparable, this is in good agreement with expected values (see [21]). Indeed, emission wavelengths are equal to 420 and 385 nm for Ce-doped LYSO and LPS. Consequently, Ce^{3+} decay time is longer than in LYSO and in LPS. However, an accurate determination of Ce^{3+} content in the compounds, which is a rather difficult task is required to check this assertion.

Another timing property, not developed here [5], concerns the afterglow phenomenon. While oxyorthosilicates such as LSO or LYSO, are well known to present this behavior [22], LPS:Ce crystals do not show any afterglow.

V. CONCLUSION

The scintillation behaviors of laboratory made LPS:Ce and LYSO:Ce samples were studied, they are gathered in Table III.

Even if $\text{Lu}_{1.8}\text{Y}_{0.2}\text{SiO}_5$ (LYSO) stopping power remains higher than that of $\text{Lu}_2\text{Si}_2\text{O}_7$ (LPS), Z_{eff} values are comparable (see Table I) and both scintillators display quite comparable behaviors in terms of light output and energy resolution. LYSO:Ce keeps advantages thanks to a high crystalline quality. However, LPS:Ce has minimal afterglow and promising high-temperature luminescence efficiency, contrary to lutetium oxyorthosilicates.

ACKNOWLEDGMENT

The authors wish to thanks C. Rozsa (Saint Gobain Crystals, USA) for measuring the temperature response of scintillation emission. We are grateful to V. Ouspenski and P. Teixeira for fruitful discussions.

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